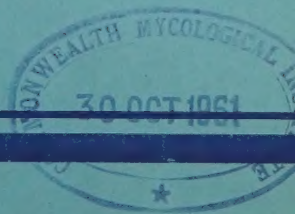


B A S U T O L A N D

DEPARTMENT
OF
AGRICULTURE

ANNUAL REPORT
1958



BASUTOLAND

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OF
AGRICULTURE
ANNUAL REPORT
1958

MASERU
BASUTOLAND

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PART I

THE AGRICULTURAL INDUSTRY OF BASUTOLAND AND ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE.

SECTION I

REVIEW

1. THE TERRITORY

Basutoland is an enclave within the Union of South Africa, some 11,700 square miles in extent. Temperatures range from occasional periods when maxima rise above 90°F. to more than 20°F. of frost in winter. Rainfall is variable, but averages 29 inches yearly, mostly occurring during the summer months, October to March. The growing season for the main crops is comparatively short, commencing with the arrival of spring rains during September to October and terminating with the advent of the first frosts, which usually occur towards the end of April.

Agriculture is the main industry of the Territory and, although maize is produced widely, particularly in the lowlands and foothills, it is consumed internally. The money-earning products are wool, mohair, wheat, sorghums and peas in that order.

Four-fifths of the Territory are steeply mountainous and almost without roads, although bridle paths and tracks, negotiable only by mules and pack-horses, abound. The 250,000 inhabitants of these parts rely almost entirely upon these small, sure-footed animals for the transportation of themselves, their produce and their requirements.

The remaining one-fifth of the Territory consists of a lowland area where soils are largely derived from sandstone, usually much less productive than the rich basalt mountain soils from which latter, rainfall and human effort are the factors largely determining the final gain.

The great proportion of the population lives, however, in the lowlands and foothills to the west of the Territory, where climatically and geographically, living conditions are not quite so difficult as in the mountain areas; but here crop yields are poor on account of soils which are fundamentally lacking in plant nutrients having been subjected to many decades of exploitation. Monoculture, lack of

return of animal and crop wastes to the soil and soil erosion form the background to the crop production picture in the lowlands.

The estimated total acreage cultivated is a little over 1,000,000 acres.

This figure continues to increase each year as more and more virgin land is ploughed up, particularly in the mountain areas where temporary homes, used in the past during the summer only whilst herding stock, tend to become permanent.

At the present rate of increase it is estimated that the population will reach 1,000,000 by 1963.

2. POLICY

In years past the Department has concentrated on the rehabilitation of the soil by the application of the most suitable methods, such as the construction of contour furrows, buffer strips, meadow strips and the building of dams in many areas purely as silt traps, and has always advocated the adoption of organised grazing methods in the mountain areas.

Throughout the years the department has continued to import selected Angora goat and Merino sheep rams in order to improve the quality of the wool and mohair clip and, at the same time, has attempted to get the co-operation of flock owners in eliminating bastard type small stock, particularly rams.

For some years past the horse-breeding section has continued to distribute to selected custodians a number of good type Arab stallions which will eventually improve the horses of the Territory and bring them back to the small stocky, hardy type of animal which is so essential for use in the rugged mountain areas. Previously the horse blood had been spoilt for this work by the misguided use of thoroughbred stallions on local mares. The thoroughbred is not a horse which can exist easily under the conditions imposed upon it by most Basuto owners.

The Departmental field staff have in past years spent most of their time encouraging the farmers to adopt improved methods of farming, but in many cases they have been forced to act as "policemen" in pursuance of these duties with the result that often the staff are not looked upon, as they should be, as the "farmers' friend", an outlook which is so essential for the furtherance of development work. As will be seen later in this report, an attempt is being made to correct this attitude on the part of the people.

Present Policy

During the year an attempt was made to assess the effect that past policy has had upon the people and to attempt to state in a simple way understandable by junior staff the policy to be adopted in the future. As a result of this enquiry a document called "Notes for the Guidance of all Members of the Agricultural Department" was circulated widely amongst staff, chiefs and administrative officers.

A paragraph from these notes is quoted as it indicates the lines along which the department now intends to work.

In the above introductory remarks the importance of human relations insofar as agriculture is concerned has been stressed. We now turn to an appreciation of the agricultural needs of the Territory and the formulation of a statement of broad policy. The Director of Livestock and Agricultural Services considers that departmental activities should be grouped under the following heads:—

- (i) Land usage (soil and water conservation, afforestation and extension work);
- (ii) Farm planning and extension on a unit basis;
- (iii) Improvement of livestock and livestock products;
- (iv) Education;
- (v) Publicity and public relations;
- (vi) Research and statistics.

This grouping is merely for convenience of presentation in this memorandum, and there is no intention of suggesting that the six items mentioned should be dealt with in isolation in the field. Indeed, extension work which has been included under land usage is vital to all the activities of the department, but all the activities of the department must, in turn, be dependent on the fundamental correctness of land usage. However, none of the departmental activities will succeed unless there is the fullest understanding, co-operation and co-ordination between specialist officers at all levels and members of the District Administration.

Considerable stress is being placed upon the importance of personal contact between the agricultural officer of a district and the progressive farmers therein. More and more time is being devoted to publicising and explaining the work of the department to farmers and to the public in general.

3. STAFF

Disposition of staff as at 31st December, 1958, is given at Appendix.

Mr. D. D. Campbell, M.C., was appointed Director of Livestock and Agricultural Services on 3rd February, 1958.

Throughout the year the post of Principal Agricultural Officer has remained vacant. Mr. A. G. Brightmore, Senior Agricultural and Livestock Officer, has acted as Principal Agricultural Officer during the greater part of the year.

Dr. D. C. L. Wachter was appointed as Veterinary Officer as from 30th December. His father was Director of Agriculture in Basutoland for many years.

Mr. P. W. A. Davies, Agricultural Officer, resigned on 1st November, 1958, and returned to work on his father's farm in the Union.

Mr. I. Tennent was appointed Assistant Soil Conservation Officer on 21st July, 1958, and is stationed at Mohale's Hoek.

Mr. M. Oosthuizen was also appointed Assistant Soil Conservation Officer on 1st September, 1958, and assists the Soil Conservation Officer at Headquarters.

Mr. A. C. Venn, Senior Scientific Officer, was transferred to Swaziland on 17th November, 1958, where he will initiate research work on the same lines as those which he carried out in Basutoland.

On 31st December, 1958, Mr. R. F. Phillips, Clerk Grade A, was transferred on promotion to Swaziland as an accountant in the Land Utilization Department.

Dr. N. N. Raditapole, Veterinary Officer, was transferred on secondment to Ghana on 9th February, 1958.

Mr. A. H. Gibson, previously Officer in charge Mechanised Group Farming, was moved to the Experiment Farm on 20th August, 1958, to act as Farm Manager.

Amongst junior staff many daily paid posts were abolished and staffing which will eventually permit of one Assistant Demonstrator per tank area (202) was introduced.

4. WEATHER CONDITIONS

Rainfall figures for the territory are given at Appendix I. In general the 1957/58 crops prospered until February, when an untimely drought caught most of the maize in the flowering stage and adversely affected yields. The winter—June/August—was particularly mild with comparatively few and light falls of snow recorded in the mountains. Spring rains were late, with the result that regeneration of the grass was delayed. This in turn delayed ploughing. The late arrival of general spring rains (58/59) has caused patchy germination in most crops and has even led to the non ploughing of quite a large number of lands—the owners of these having decided that they will not reap worthwhile crops consequent upon late planting.

5: VISITORS AND VISITS

His Excellency the High Commissioner, Sir Percivale Leisching, paid a farewell visit to the Territory during August. Among the many other visitors in chronological order were Dr. Botha, Director of Crops and Pastures in the Union; Mr. Greening, an Agricultural Officer from Northern Rhodesia; Mr. Garland, Registrar Wye College; Mr. Beach, American Consul-General in Johannesburg; Mr. Shannon, of the Commonwealth Relations Office; Mr. C. Alport, Parliamentary under Secretary of State; Messrs. Strong and Kerr, representatives of Longmans Green, in connection with the proposed production of a book on agriculture in Basutoland; members of the Imperial Defence College; Mr. Surridge, Adviser to the Secretary of State on co-operative matters; Professor Lewis, of Ghana University Vice-Admiral Watson, Commander in Chief South Atlantic; Sir Rex Surridge and Mr. Phillips, a Union authority on wool and textiles.

Members of the staff of the department paid visits to neighbouring territories as follows:—

Dr. Brown, Principal Veterinary Officer, attended meetings of veterinarians in Bloemfontein, Bulawayo and Onderstepoort.

Mr. Bennie, Wool and Mohair Officer, visited the Grassland Research Station at Ermelo and the Dohne Research Station near East London, inspected Basutoland wool at the ports of Durban, East London and Port Elizabeth and attended meetings of the S.A. Wool Board at Pretoria.

Mr. Youthed, Soil Conservation Officer, visited Lourenco Marques to attend the SARCCUS Conference.

Mr. Bisschoff, Senior Agricultural and Livestock Officer, who was

nominated as Territorial representative to the Wheat and Mealie Industry Control Board's paid visits to Pretoria in connection therewith.

Mr. Brightmore, Acting Principal Agricultural Officer, attended the Conference of Directors and Senior Officers of overseas Departments of Agriculture and Agricultural Institutions, held at Wye during September.

6. DISTRICT NOTES

These notes are taken from the annual reports submitted by the A.L.O. in charge of each district.

Maseru

Maize and sorghum yields were below average, due to two very dry spells in December and March. Good crops of mountain wheat and peas were reaped. Sales of fertilizer rose from 142 pockets in the previous year, to 500.

There are a greatly increased number of vegetable gardens in the district and requests for fruit trees are increasing.

The various associations of the Basutoland Agricultural Union and Homemakers comprise some 27 branches, with a total membership of 772.

Due to low wool prices the sale of Government stud rams has fallen off, and for the first time in many years there is a large carry-over of unsold merino rams.

Berea

Maize and sorghum yields were average and mountain wheat and peas were slightly better than average.

A notable departure from traditional crops is the increased area under potatoes. The farmers are learning that a cash crop is better economy than just trying to grow their own food.

The use of fertilizers rose from 997 bags to 1,546, and in addition 5,229 bags of kraal manure and ash were applied to the lands.

The farmers of the district were very successful at the Central Agricultural Show held in Maseru and carried off a large number of prizes. The women, too, were very successful, particularly in the sections for dried and canned fruits.

There are 44 progressive farmers in the district and only lack of trained field staff prevents the number from being much larger.

A number of farmers were, as an experiment, granted agricultural credit through the department by being advanced fertilizer and seed to the extent of £77 5s. in value. If the results are sound the scheme may be extended next year.

Liaison with the schools was good and demonstrators gave many talks and demonstrations to scholars. A very successful school garden competition was held.

There are three co-operative societies and interest and membership are gradually growing.

As an example of enterprise a sowing of 2s. worth of vegetable

seeds produced a revenue of £9 12s. 10d. to the grower by means of the sale of seedling plants.

Leribe

The maize and sorghum crops of this district were about average but mountain wheat and pea crops were adversely affected by the December drought and yields were well below average. There has been a marked increase in the amount of potatoes grown and crops have been fair to good, giving a good cash return to the producer.

Fertilizer sales rose from 398 bags in 1957 to 600 bags and report is made of an increasing number of farmers who apply kraal manure and ash.

There are 37 branches of the Basutoland Agricultural Union and Homemakers Societies with a membership of 1,125. Some are moribund but quite a large proportion are active and some are very keen.

There were 661 exhibits from 295 exhibitors at the local agricultural show and competition was keen.

A commencement of the Progressive Farmers scheme has been made and at the present time 36 are registered.

In this, as in other districts, there is a strong demand for both pigs and poultry from the Department, a demand which cannot nearly be met.

There are three very active co-operative societies. Two are wool and mohair marketing societies and the third is a farmers' consumer society which obtains agricultural needs such as fertilizers, seeds, tools and implements for its members.

Butha Buthe

Good crops of sorghums and maize in the lowlands, and of wheat and peas in the mountains were harvested.

Again potatoes were increasingly grown as a cash crop with fair to good results. At the present time 1,672 pockets of seed potatoes have been planted and show good promise. In this district 2,783 pockets of fertilizer were used and 13,698 bags of kraal manure and ash were applied. It would appear that Butha Buthe is by far the most progressive district in its use of manure and fertilizers. There are 30 gardeners' associations, a feature which facilitates the work of the department, as advice on gardening can be given at gatherings of the members instead of to individuals; also distribution of seed and fertilizers is much easier when done through the associations.

Fruit-growing is increasing in popularity and farmers planted 873 trees, mainly peaches, but quite a few apples, apricots and plums.

There are 28 association branches, with a total membership of 322, which are fairly active. The women, in particular, are very keen and their associations are in a sound financial position.

At the local agricultural show there were 954 exhibits from 621 exhibitors, the exhibits being of a much improved quality over those of previous shows. The increased rivalry between districts and between the central show is growing healthily. The officer of this

district reports with justifiable pride that farmers from Butha Buthe almost "swept the board" at the Leribe show.

There are 30 progressive farmers, mostly chosen from local farmers' associations.

Excellent co-operation between the Agricultural and other departments and also with the local ward chiefs is reported from this district.

Mokhotlong

This district had very good rains and frosts were late in the autumn, with the result that the yields of maize and sorghums were exceptionally good. Wheat was adversely affected by the rain and crops were poor, but peas were excellent.

This is a mountain district with mostly rich soils, and because of this and transport difficulties, fertilizer is not supplied through the department. It is reported that there was a definite increase in the use of kraal manure and ash, and that certain farmers were using the chaff from the threshing floors as compost. There are many keen gardeners in the district and a noteworthy point is the gradual widening in the range of vegetables grown. From the traditional use of only carrots, turnips and cabbage the demand has extended to tomatoes, leeks, beetroot, onions, cauliflower, squash, pumpkin and artichokes. There are three agricultural associations with a membership of 85. It is reported that the women are the real backbone of association activities; they get on with the job while the men sit in conference and argue over petty jealousies.

There are 45 progressive farmers who have all made definite efforts to follow actively the advice of the Department. Such revolutionary measures to the Basuto as winter fallow ploughing and the thinning out of crops have been cheerfully accepted. Many have manured their lands for the first time in history. There is a new hope and pride in their activities.

It is reported there is a far better understanding of agriculture in schools than previously. This is ascribed largely to the Basutoland Farmers Journal, which is bought by students to help them in their studies of agricultural subjects.

Despite great climatic difficulties tree planting is progressing. It has been learned that in this cold climate only very short willow stumps will grow, and that conifers need to be protected with a grass mulch and covering against frosts. A technique gained from experience is being evolved and trees are beginning to grow where they have never been before.

There is only one co-operative society, but this is a large wool and mohair marketing venture which handles 1,000 lbs. of wool daily during the shearing season.

Mokhotlong district depends on air communication for mail and much of its passenger traffic. There were two air crashes during the year, neither fatal. In one of the crashes two European officials of the department were involved together with a visiting agricultural official from the Union Government. They were rescued from an inaccessible valley by helicopter after a night in the open, one with a

damaged back and one with a broken ankle. Fortunately all are now fully recovered and back on the job.

Qacha's Nek

There were good crops of maize and sorghums in the valleys and excellent crops of wheat and peas in the mountain areas. This is another district difficult of access, but sales of fertilizer went up from 33 to 67 pockets, and it is reported that progressive farmers applied 750 bags of kraal manure to their lands.

There are 37 progressive farmers who are very keen. One has fenced an area and started his own tree plantation. The Ward Chief has also started his own tree plantation.

Liaison with the Education Department is excellent, and of the 109 schools in the district 77 have vegetable gardens. Nine schools have tree plantations and several are carrying out small soil reclamation schemes in their vicinity.

Cattle sales were again popular in this district, some 832 head of cattle and 568 sheep being sold at the five sales held during the year.

Quthing

It was a poor crop year for Quthing district due to a hot, dry spell in February and March. All crops suffered as a consequence.

There are five agricultural associations with a membership of 530. Between them three small agricultural shows were run at various centres and although the number of exhibits was small the standard was pleasingly high.

There are 58 progressive farmers in the district. They are not in possession of carts to take manure to their lands and some of them have used pack donkeys for this purpose.

The two co-operative societies in the district have combined and have opened two shops through which they are supplying agricultural requirements to farmers.

Mohale's Hoek

There was a fair crop of sorghums in this district but all other crops were badly affected by drought and poor yields resulted. Throughout the district the peach crop was so heavy that trees were broken. A large amount was dried for winter use.

Fertilizer sales increased from 42 to 55 pockets and 720 bags of kraal manure and ash were used.

There are eight men's agricultural associations, with a membership of 72, and 18 women's associations, with a membership of 222. They are just beginning to understand and practise self help. Hitherto their idea of an association has been to group together and request government assistance. During the year they combined and ran a successful agricultural show.

There are 56 progressive farmers whose standard is fairly high. The majority are in the Phamong Ward.

A separate report is given on the Taung Reclamation Area which falls in Mohale's Hoek district.

There has been a decrease of over 50,000 small stock in the district. This is put down mainly to slackness by the farmer in dosing regularly against internal parasites. The small stock population is approximately 127,000. Figures show that only slightly more than 50 per cent were dosed.

Although progress outside the Taung area is slow, there are definite signs of an awakening interest in agriculture and the staff approach 1959 with optimism.

Mafeteng

It was not a good crop year in this district. A dry spell after Christmas affected both maize and sorghums. There is no mountain area. The foothill wheat and pea crops were also not up to standard.

Fertilizer sales crept up from 43 to 61 pockets and it is reported that there was some manuring with kraal manure or ash.

An attempt to hold a garden competition failed through lack of public support, and it is stated there are no gardeners' associations. The same sorry story applies to farmers' association—they do not exist.

A small agricultural show was held at which there were 180 exhibits from 60 exhibitors.

There are 30 progressive farmers and it is hoped they will be brought up to the standard of master farmers. This appears to be doubtful at present but it is possible that a change of heart will occur and we shall see more enthusiasm as they progress.

Liaison with the Education Department has been good. School children have planted trees and are looking after them well. Demonstrators have given regular talks and demonstrations to schools and there is hope that this will have some effect on their elders.

A red-billed teal, shot in Mafeteng on 18th March, 1958, had been ringed at Barber's Pan, Western Transvaal, in May, 1956, by the South African Ornithological Society.

During May of 1958 the District Commissioner and the Agricultural and Livestock Officer hired a bus and took the whole of the District Council on a tour of the District. The object was to point out what was being done and what was hoped to be done by the department. At the end of the tour the Council said: "We take our hats off to the Agricultural Department. We had no idea of the magnitude of their efforts. We see the lack of co-operation of our people and promise to do our best to overcome it."

SECTION II

AGRICULTURAL EDUCATION AND PUBLIC RELATIONS

1. AGRICULTURAL SCHOOL

Despite staff and transport difficulties steady progress has been made in the development of the school.

A large Colonial Development and Welfare capital grant of £10,070 was approved during the year and this has been used to supply badly-needed accommodation, equipment and laundry facilities.

The resident staff consists of an Agricultural Education Officer (Principal) and two full-time teachers, assisted by three station officers and five officers from Maseru, all of whom handle their own particular subject. Teaching is thus still largely dependent on part-time instructors who often find it difficult to maintain a programme of lectures in addition to their territorial duties.

The school lacks suitable and adequate transport.

Students

The scheme whereby selected entrants spend three months working in the field under departmental officers before commencing their studies is operating well. Not only do students become *au fait* with the work of the department but they get an insight into some of the technical and human problems which characterize agriculture in this territory.

The second graduation ceremony took place in April, 1958, when twelve men were presented with their diplomas by Mr. R. E. K. Murray, O.B.E., Senior District Commissioner. All the graduates were subsequently absorbed into the department as Assistant Demonstrators and, according to reports, are doing as well as the first group. There is no doubt that the school will in time make a considerable impact upon agriculture in Basutoland. During December, 1958, 91 applicants were interviewed for appointment to the 20 vacancies at the school occurring in July, 1959. It is worthy of note that of these 91 applicants 78 had received post primary education.

Farm Units

Further progress was made in the development of the four agricultural units, which, while essentially investigational, form an admirable training ground for the school students. Each unit consists of six acres of arable land and a 25-acre share in 100 acres of "communal" veld grazing: (a) Fresh milk production; (b) Poultry and egg production; (c) Butter production and the sale of pigs and (d) Crop production and sheep farming form the basis of the four systems. Only animal traction is used. While students are allocated to particular units in respect of arable land, they work on the unit "headquarters" in rotation, thereby gaining a wider practical experience. The standard

of farming on the units is higher than that met with generally in Basutoland but it is not so high as to be unattainable by progressive farmers.

Much use is made of these units as a means of demonstration when courses for progressive farmers are held or when interested farmers visit the Experiment Farm. An attempt is being made to cost these units in order that the figure so obtained can be publicised amongst farmers.

Grass Nursery

Under the direction of the Agricultural Education Officer a grass and legume nursery has been established. At present this comprises approximately 40 varieties, the majority of them being new introductions to Basutoland. Despite the dry winter conditions which have prevailed this season certain of the grasses and clovers have given most encouraging results, in particular, Red Alsike and Molasses grass (*melinis Minutiflora*). Observations and further experimentation in grass and clover mixtures will be continued.

Courses

During the year two vocational courses were held at the school. The first course catered for departmental staff and was attended by 32 demonstrators. Instruction was mainly practical and was based on the type of knowledge demonstrators would be expected to have when dealing with progressive farmers.

The second was attended by 36 selected progressive farmers from all over the territory who paid £1 each for a course of four days duration. Once again the practical side of farming was stressed.

Both courses proved exceedingly popular and were it possible to increase accommodation and staffing at the school there is no doubt that such courses would rapidly benefit both staff and farmers. At present it is only possible to run courses during the limited and often unseasonal holiday periods.

The school and farm continue to prove an attraction to visitors and, during the year, were seen by 65 teachers accompanied by 336 children.

2. PUBLIC RELATIONS

Publications

The department has adopted a new policy with regard to extension work and is placing greater emphasis on public relations.

Hitherto the approach to the public has been almost exclusively by word of mouth, at the traditional "pitso" (tribal gathering) and by practical demonstration through district Agricultural and Livestock Officers and their field staff of demonstrators. Little attention has been paid to more up-to-date methods of approach.

It has been recognised that a new concept of extension methods is desirable, and this has taken the form of seconding one officer to the work and allowing him to develop public relations in a form suitable for the Territory.

It can be assumed that from one-third to half the population can read and assimilate simple written text in Sesotho and that this section of the population is steadily increasing; also that there is a small but steadily increasing number of people with higher educational standards. The time has come, therefore, when the people can be reached by means of the written word.

The public relations methods adopted at the present time have followed established practice, and well known and proven methods. A Basutoland Farmers Journal, which was started three years ago, has a circulation of 5,000. This, together with articles submitted to the three vernacular weekly newspapers, forms the means of approach to the more advanced reader.

A monthly agricultural bulletin in the form of a broadsheet, which covers a prevailing activity at the time of issue, is also published. This is written graphically in a simple manner understandable to most readers. Through the field staff 10,000 copies are handed out each month.

Other pamphlets and booklets are being prepared for use by the public and by the departmental field staff. The response to the bulletins has been immediate and definite. The field staff are very keen about them and there is no doubt that they have stimulated interest to a marked extent.

Photographic exhibitions are being prepared. These will be placed on display in public offices and schools. Coloured slides and film strips are also being prepared for use at meetings and lectures. It remains to be seen what effect they will have or how popular they will be. The objective of the foregoing methods is to stimulate interest and to gradually educate the population to more constructive thought and to prepare it for more advanced development in the future.

Progressive Farmers

The department, in its closer relations with the farming community, is sponsoring the establishment of a group or association of progressive farmers. The idea is to have a body of farmers, whose methods are progressive, and who have reached a certain standard of efficiency, on whom the department can concentrate its efforts. For details see Section III, Progressive Farmers.

Training Farms

Another activity which falls within the aegis of public relations work is the establishment of three small training farms, one in the north, one in the centre and one in the south of the Territory. These will be of the average size of holding in the Territory, that is six acres of arable land. Improved lay-out and style of farm buildings, but of a standard within the scope of the Basuto farmer, are being erected. Poultry, cattle and pigs will be kept. Crops traditionally grown by the Basuto will be raised, following an accepted crop rotation. A small orchard and about one acre of market garden is being established

at each centre, as well as facilities for supplementary watering of these plots.

The farms will be used for demonstration purposes and for the holding of courses of instruction for field staff and bodies of progressive farmers and master farmers. In addition the sons of farmers will be accepted as trainees in practical agriculture and will perform all the duties on the farms under the guidance of the demonstrator in charge.

A further feature of the farms is an information room, where permanent agricultural exhibits will be displayed. These rooms will be places where any member of the agricultural community may go for advice or to be given practical demonstrations.

The farms will also be used for the reproduction of both improved seed and improved livestock, which will later be made available for distribution to progressive farmers.

General

In addition to the foregoing the improvement of public relations is gradually building up an improved liaison between the department and such bodies as the Basutoland Agricultural Union, the Basuto National Teachers' Association and the Women's Homemakers Associations; arranging for lectures by specialist officers, judging at competitions and helping with the arrangement of courses of instruction and agricultural shows.

Although this work was only started early in November and is as yet in its infancy there are obvious signs as to its value. Letters from Basuto have been received from as far afield as the Northern Transvaal, applying to attend training farms as trainees, and many have commented on both the newspaper articles and the monthly agricultural bulletins.

The interest is there and if it can be wisely stimulated and held there should be a marked improvement in the agriculture of the Territory. The application of development schemes in the future depends to a large extent on the preparation of the public for them. The importance of the education of the public, by all the media available and suitable for the Territory in its present stage of development, cannot be over-emphasised.

3. LIAISON WITH PARAMOUNT CHIEF

These notes are submitted by Chief Ntseke Molapo, Administrative Assistant to the Director of Livestock and Agricultural Services.

(i) Relations

Relations with the Paramount Chief and Advisers were very close and cordial. The Paramount Chief and Advisers gave the department full support in all agricultural matters. Most of the Principal and Ward Chiefs in the districts showed active co-operation with departmental staff.

(ii) Maintenance of Soil Conservation Works

Maintenance work continued to deteriorate throughout the Terri-

tory because of lack of supervision on the part of the chiefs. There was, however, an area in the Maseru district where one energetic supervisor produced some good work after all the men under him were formed into a team which was supplied with tools by the Basuto National Treasury. This team tackled certain areas where much damage had occurred to anti soil erosion works. They did excellent work which should be an example to people of other areas. As a result of discussions and conclusions in the National Council the old system of responsibility over maintenance work has been changed. It will now fall under a committee in each district appointed by district councils. It is hoped that by this new method a better management will be accomplished.

(iii) Noxious Weeds

Good work was done in the eradication of noxious weeds in the northern districts. This was fortunate as these areas are the sources of rivers which are great carriers of the seed of noxious weeds. There was some improvement in the Maseru district this year, especially in the Thaba Bosiu Ward, where the young chief who has succeeded to the chieftainship is making a real effort to improve matters in his ward. In the other wards much work remains to be done. In the Mafeteng and Mohale's Hoek districts only a few chiefs made some attempt to clear their areas after the Administrative Assistant had visited them to address meetings of chiefs in this matter. Mafeteng is the worst of all districts in its negligence of this work.

(iv) Opening of Thite (Virgin) Lands

Ploughing of thite lands again caused a lot of trouble in the Territory. This was especially the case in the Maseru, Mohale's Hoek and Quthing districts where some of the prominent chiefs flouted the law in their areas. It is most disappointing when some of the supposed leaders of the nation behave in this manner. Almost all the areas which are being wantonly opened up are in the mountain regions which are not suitable for cultivation at all but are essentially grazing areas. The nation is in danger of losing its great asset of grazing through the thoughtless action of certain individuals. The tragedy is that these lands do not last long as they quickly become eroded, the soil is washed away and bare rock exposed; thus they become a total loss to the nation. It is necessary to travel through the mountain areas to realise the extent of the damage. In the other districts most of the chiefs seem to have realised this danger and there is little, if any, damage done in their areas.

(v) Land Tenure

During the last ordinary session of the Basutoland Council there was a very interesting discussion on a suggestion to change the present system of land tenure which was described as antiquated, out of date,

and was the basic cause of all drawbacks in the proper usage of land in Basutoland. Although the motion was narrowly defeated it is encouraging to see that there are some of the Basuto leaders who realise that a change is necessary if the Basuto are to get full advantage out of their soil, which, at present, is greatly wasted.

(vi) Other Activities

Among other duties which were fulfilled by the Administrative Assistant were lectures given at the Agricultural School on the laws, rules and orders applying to agricultural matters in the Territory; assisting officers of the department in their dealings with the Basuto authorities in regard to their work; attending meetings and explaining and interpreting to the people the aims and objects of agricultural work and discussing with chiefs and people nutrition matters at the suggestion of members of the World Health Organisation team.

SECTION III

OTHER ACTIVITIES

1. PROGRESSIVE FARMERS

During the year every assistant demonstrator was instructed to find in his area a number of farmers up to ten who were willing to accept advice from the department and were at the same time genuinely interested in improving their farming system. Instructions were issued that departmental staff should devote more and more of their time to attempting to raise these people above the level of surrounding farmers.

The scheme, known departmentally as "The Progressive Farmers Scheme", produced interesting information concerning the type of people who were keen to join.

The following are examples of the type of person brought to light:—

A man in Butha Buthe district who bred very fine Basuto ponies for which there is a considerable demand from outside the Territory.

An ex-school-teacher at Morija who incubates large numbers of eggs in a home-made incubator (holding 200 eggs at a time) and supplies poultry and eggs to a large number of local residents.

A woman at Teyateyaneng who for some years now has grown and harvested successfully a good crop of groundnuts. She also maintains a good "sty" of pigs.

A chief who has attempted to grow cotton and tobacco. Since the inception of the scheme approximately 350 future pro-

gressive farmers have been registered, details are recorded of their holdings, stock, activities, etc., and agricultural officers and their staff have spent a considerable amount of their time working with these people at their homes.

Instructional courses are held in turn at the homes of these progressive farmers and this enables the owner at whose home the course is held to display his work to the others.

A very successful course was held at the Agricultural School for 36 of these farmers.

2. MACHOBANE AGRICULTURAL SYSTEM

Mr. Machobane continues to arouse considerable enthusiasm amongst farmers in the northern areas of Basutoland by his novel and unorthodox extension methods. He has gathered round him a large number of people who have been granted an advance of money in order to purchase seed, fertiliser, etc., and who have agreed to follow the rather complicated pattern of inter cropping laid down by Mr. Machobane. It is too early yet to state whether in this advance of cash lies Machobane's main attraction. It is quite definite, however, that Mr. Machobane's extension methods are producing results. His followers hope to harvest a large potato crop during the coming season.

The department has taken a keen interest in Machobane and his system and has laid out a trial plot according to his system at the Experiment Farm. At present there seems little reason to believe that intercropping will result in increased food yields.

The main value of Mr. Machobane lies in the fact that he can arouse enthusiasm amongst agriculturalists. How his extension work and that of the department will eventually tie up has not yet been decided.

The department has also granted an advance to certain farmers in the same area who will farm under departmental advice, in order that results obtained from the two systems can be compared.

3. CO-OPERATIVE SOCIETIES

During the year an ever closer link was forged between this department and that of the Registrar of Co-operative Societies than has existed in the past.

The full report of the Registrar, published separately, will indicate the activities of his department in connection with agriculture.

The department has continued to assist Wool and Mohair Co-operative Societies by making accommodation and trained classers available and by instructing co-operative employees in wool and mohair classing.

Cattle sales have proved a considerable success and in many places

this department and the co-operatives have worked together to organise these sales. The weigh band system of purchase, although having certain drawbacks, has, on the whole, proved successful and there is no doubt that cash payment on the spot has a great appeal.

Departmental propaganda is spread through societies and much of the stock held by the Advance Account, such as fertilisers, insecticides and seeds, is sold by societies to farmers. In Butha Buthe district the co-operative dealt with 1,633 bags out of a total of 2,783 bags sold to the farmers. In return the department has purchased seed from the co-operative societies which is then redistributed to farmers. This can in future form an important aspect of the work of societies. Many of the local varieties of seed, for example "Pink Wacher Beans" are unknown to the trade but are high yielding and very acceptable, to local people. To obtain bulk quantities of pure seed is difficult and it is in this respect that societies have helped and can do so increasingly in the future.

4. TRACTOR HIRE SYSTEM

During the year it became apparent that some of the co-operative tractor groups would fail. This in fact happened and three tractors were removed from failing groups and handed over to custodians.

For some time the Basuto farmers have shown that instead of belonging to a co-operative they would prefer to hire a tractor whenever they consider they need it.

In most cases the demand for the use of tractors varies inversely with the amount of grazing available at the beginning of the ploughing season in October. In order to help individuals who were keen to own and operate tractors the three tractors removed from the groups were issued to custodians who in return for the use of the tractor and its equipment agreed to supply the department with their operational costs. As will be seen from the attached details results have varied according to the effort of the individual and his business acumen.

However, there is no doubt that the Basuto, in regard to tractor operation, remains an individualist and that an efficient hire service is what is wanted by most of the farmers.

It is significant that since the inception of the mechanised group farming scheme the number of privately owned tractors in Basutoland has risen from 10 to more than 60.

CUSTODIAN TRACTOR FARMERS

INCOME AND EXPENDITURE FOR YEAR ENDING 31ST DECEMBER, 1958

<i>Name of Custodian</i>	<i>Started Operation</i>	<i>Hours Worked</i>	<i>Acreage Share Basis</i>	<i>Acreage Worked</i>	<i>Gross Profit</i>	<i>Expenditure</i>	<i>Depreciation</i>	<i>Nett Profit</i>	<i>Nett Loss</i>
Mokoaleli	August, 1958	877	—	172	£229 9 0	£90 14 7	£105 19 5	£32 15 1	—
Mofolo	April, 1958	420	26.45	143.45	£184 15 6	£181 16 7	£50 15 0	—	£32 11 7
Lipholo	June, 1958	769	31	250 appr.	£200 0 0	£172 0 0	£92 0 0	—	£64 0 0

5. TRADING ACCOUNT

The trading account has been publicised this year by members of the staff and also by the issue of 20,000 handbills distributed throughout the Territory over a period of two months.

As a result of the increased interest in the account and the concentration by staff on progressive farmers who have been urged and are keen to purchase requirements through the account, the demand in many cases exceeded supply. This is not satisfactory and now that some indication of the probable demand has been established every effort will be made in ensuing years to ensure that farmers get what they ask for. As will be apparent from the following table certain sales have increased by unpredictable amounts.

	1958	1957
Sorghum seed	1,800 lbs.	400 lbs.
Vegetable seeds	215,640 packets	76,359 packets
Maize seed	29,800 lbs.	11,600 lbs.
Bean seed	3,000 lbs.	600 lbs.
Potato seed	43,163 lbs.	5,513 lbs.
Wheat seed	18,400 lbs.	200 lbs.
D.D.T. Powder, 2½%	2,690 lbs.	1,595 lbs.
Dieldrin	981 ozs.	25 ozs.
Seed dressing	1,557 ozs.	Nil
Superphosphate	445,500 lbs.	324,875 lbs.
Nitrogenous fertiliser	3,500 lbs.	Nil
Carts	31	67

During the course of the year the account which hitherto had been an advance account was converted to a trading account, thereby permitting the continuous use of the sum of money involved. On the operation over the year a profit of £723 19s. 6d. was made.

Storage facilities have been opened up at two sub-depots, Leribe and Mohale's Hoek, in order to facilitate distribution in the future.

Special expenditure of £960 was approved to permit the building of a large storage shed in Maseru.

Discussions were held with the Registrar of Co-operative Societies concerning the possibility of handing over the management of this account to the Co-operative Societies, with whom the department has continued to liaise closely.

The account is mainly used to supply farmers with agricultural requisites which are not normally stocked by traders. In time it is hoped that the trade will be encouraged to stock articles which prove popular and so relieve the department of this duty.

6. MASERU EXPERIMENT STATION

Another allocation of £10,070 during the year for capital works at the Agricultural School—all part of the Experiment Farm—has involved the farm management staff in much supervisory work.

Like any other farm the continued growth and development of capital assets and productivity of the acreage under cultivation has brought with it management problems which have to a great extent been solved by bringing in an Agricultural and Livestock Officer to the farm to act as farm manager under the Officer in Charge.

The following postings took place during the year:—

In March, an Agricultural Officer, Mr. A. C. Macintosh, was appointed and Mr. P. W. A. Davies, Agricultural Officer, was transferred to Qacha's Nek. In May, Mr. A. C. Venn, the Soil Fertility Officer, proceeded on overseas leave prior to transfer to Swaziland, and Mr. A. C. Macintosh took over duties of Officer in Charge.

Mr. P. Tsoeu was acting farm manager from May until August when Mr. A. H. Gibson, Officer in Charge Mechanised Group Farming, was appointed to the post and transferred from Teyateyaneng.

In August, Mr. M. M. Thatho, the Experimental Assistant, left to further his studies overseas and, in November, Mr. E. M. Matsela was promoted to fill the vacancy.

The staff at the Agricultural School remained unchanged.

These many staff adjustments have necessarily resulted in a certain lack of continuity but, in spite of this, progress has been good.

Research

The large programme of experiments at the main station and the six district sub-stations was continued. Co-operative fertiliser trials on farmers' holdings were repeated. The exploratory fertiliser trials in Swaziland were continued pending Mr. Venn's transfer to that territory.

The greenhouse pot experiments on trace elements continued and very satisfactory results were obtained until March, when the temporary greenhouse structure was damaged in a severe storm. A new permanent greenhouse is now nearing completion.

Further progress is being made in the four investigational and training units at the station.

In Section I of part II of this report are detailed the results of 1957/58 investigations in Basutoland. Below is a summary of findings:—

Variety Trials: On maize, wheat, beans, cowpeas, peas and sorghum variety trials were continued at the main station, Machache and Mokhotlong. The sorghum variety trial at Machache was completely destroyed by hail. Mountain wheat variety trials have reached the stage when the eight most promising varieties will be propagated and distributed to farmers in the 1958/59 season. Now that the basic fertiliser requirements of crops in Basutoland have been established more attention must be paid to variety selection.

Fertiliser Trials: The black clays of the mountains are extremely fertile and, in general, do not require fertilisers. The improvement of production in this region will depend mainly on personal effort, prevention of erosion, the use of suitable varieties and cultural practice.

(1) *Nitrogen.* Nitrogenous fertilisers improved yields on all sites in the lowlands, irrespective of plant population. In contrast to

previous results there were no interactions between nitrogen and plant spacing on maize. This is probably attributable to the unusually wet season under review when there was a certain amount of leaching and/or the impediment of mineralization under conditions of excessive soil moisture. Rainfall exceeded the average in the spring and it seems reasonable to recommend extra side dressings of nitrogen on lowland soils whenever rainfall is excessive.

There were the usual responses to added phosphate and consistent N.P. interactions in the lowlands. The pattern from four experiments is:—

			Legend
PO	P ₂		NO = Nitrogen nil.
NO	7.9	8.6	PO = Phosphate nil.
N ₂	7.2	14.7 bags/acre	N ₂ = Double application nitrogen.
			P ₂ = Double application phosphate.

Six weeks after planting seems to be the best time for application.

All winter nitrogen treatments increased yields. The effect of summer side dressings was low but significant.

Eragrostis curvula responded well to nitrogenous top-dressings.

(2) *Phosphate*. All crops showed responses to phosphate fertilisers on foothill and lowland soils. After the third successive season basic slag and Raw Rock phosphate (high grade) are superior to super-phosphate.

(3) *Potash*. No responses to potash were recorded.

(4) *Lime*. Four years after application lime increased yields substantially on red ferruginous soils but heavy applications on grey soils caused an iron chlorosis and a reduction in yields.

(5) *Manure and Manure Ash*. These continued to give yield increases.

(6) *Trace Elements*. A molybdenum deficiency in certain soils has been established.

Results of a possible zinc deficiency were inconclusive. A deficiency of manganese on a foothill soil has been confirmed. Further research is being undertaken to investigate a possible sulphur deficiency indicated by pot experiments.

Pot Experiments gave valuable initial information on trace element deficiencies.

The Farm

Consisting of 660 acres, this is where the main experimental work and training of students is carried out.

Farm maize crops were excellent, yields ranging from 16 to 22 bags per acre. A total of 769 bags were harvested. Owing to late planting the bean crop was disappointing. Approximately two tons of lucerne hay and three tons of grass hay remained after feeding the farm livestock for the year.

Pigs and Poultry. During the year the following livestock were bred and sold to Basuto farmers:—

Weaner pigs ...	...	...	30
Eggs for hatching ...	...	...	635
Three-month-old fowls	...	...	1,431

Poultry. The sale of poultry was discontinued when a routine check showed the presence of B.W.D. All breeding birds and chicks on hand were then disposed of and distribution discontinued. New breeding stock has already been purchased in preparation for the 1959 season.

Pigs. Owing to the difficulty of obtaining suitable bloodstock it was decided to discontinue breeding large blacks and to continue with the Minnesota No. 1 breed. The change-over will be gradual. Two Minnesota gilts and one boar were purchased.

Forestry. 1,920 boxes of seedlings and 39,700 young deciduous trees were grown for planting in Maseru district at the farm nursery.

Development on the Farm

- (1) One rondavel was built.
- (2) A permanent greenhouse is nearing completion.
- (3) Electricity from Maseru is being installed and should be available before the end of the financial year.

New Crops. Besides the usual crops of maize, beans, lucerne and *Eragrostis curvula*, field plantings of groundnuts, sunflowers and linseed have been established to ascertain their suitability for use as cash and rotational crops in the territory. Soft fruits have also been tried out on a field scale.

Grass Nursery. Under the direction of the Agricultural Education Officer a grass and legume nursery has been established, comprising approximately 40 varieties at present. Despite the dry winter conditions certain grasses and clovers proved most encouraging, as are initial observations on summer plants.

7. LAND USE PLANNING: PROGRESS

Progress in this field falls into two sections:—

- (a) Technique;
- (b) Application.

Technique

Maps until recently have merely been used as a means of finding one's way about and as a medium on which points of interest could be marked. However, their value is now more fully appreciated and the 1:50,000 sheets are now being used extensively for plotting references in connection with survey work. Land classification surveys were started in Taung ward and the various land categories were plotted as accurately as possible on these maps. All went well until the maps had to be used for checking field work. It was then realised that

the maps did not have sufficient physical detail for this work and many discrepancies were observed.

It was then decided to use aerial photos for plotting and checking purposes. This has proved most satisfactory. The detail provided on the photographs permits very accurate plotting and facilitates checking afterwards.

The photos, however, lack linear accuracy and it is then that the maps are resorted to for the purpose of extracting areas and distances. This can be done quite satisfactorily.

The planimeter is extensively used in area computation and its use is now developed to a satisfactory standard of efficiency.

Stereoscopic analysis of aerial photos is now being carried out and has proved to be very accurate in interpreting ground conditions by direct reference to the photos, despite the fact that the aerial photographs in use are several years old.

Whereas in the beginning land analysis surveys had to be made on horseback by direct observation in the field, it can now be done to a very large extent in the office by means of aerial photos, the stereoscope, maps and planimeter. The office work only requires checking in the field and thus much time is saved.

There is still much room for improvement and it is intended that advice will be sought from the Directorate of Colonial Surveys in this connection.

Application

The Taung Rehabilitation Scheme initiated the system of land use survey and the analysis was applied to 150 square miles of territory. The analysis of grazing and arable land was done by means of direct field observation and the use of maps. As stated previously, aerial photos have now replaced the maps.

In another area 60 square miles of the Tebetebeng catchment was analysed by means of aerial photographs and some very valuable information was obtained. (See Pilot Project report). Stereoscopic observation was used extensively in this case for the identification of certain topographical and geological features.

Aerial photos are also being applied to grazing control planning and promise to be very useful indeed. A grazing control system has been suggested for use in the Ox Bow Lake catchment area based upon information obtained from maps and aerial photographs.

A survey of erosion along the Caledon River was carried out and maps and aerial photos were once again used for this purpose. The survey is not yet complete but it is appreciated that it would hardly have been possible without the use of photos and maps.

8. LIAISON WITH MEALIE AND WHEAT INDUSTRY CONTROL BOARDS

Maize, for the shortfall of territorial requirements, is imported from the Union, where the whole industry is under the control of the Maize Industry Control Board. The exportable surplus of Basuto-

land wheat is similarly controlled by the Union's Wheat Industry Control Board. Prices, grading, etc., conforming to regulations for these grains require constant contact with the respective Control Boards. An officer of this department represents the interests of Basutoland on these Boards. He also represents Swaziland and Bechuanaland at Board meetings.

Control

(i) *Maize*: There are no grading regulations in force in the Territory and the only control which existed in the past was a control on the maximum re-selling price of Basutoland maize. In the absence of a grading system and several other factors affecting the grain trade, the control was considered unenforceable and unnecessary. Internal price control was consequently lifted in June of the report year. This has had the effect of permitting traders to pay higher prices for local maize at stations and thus retain higher maize stocks, which could again be resold at prices lower than imported maize. It is considered that local maize prices for resale will not exceed the cost of imported grain.

Experience during the latter half of the year has shown that decontrol was justified.

(ii) *Wheat and other Grains*: There is no internal control, the bulk of the crop being exported.

(iii) *Sorghum*: Sorghum exported to the Union usually falls into the Grade K4 and is disposed of through the Mealie Industry Control Board. The Board has experimented with two marketing schemes during the past two years. Firstly the Board paid the producers an advance price (lower than the estimated market value) and later the balance, being the difference between the advance price and actual selling price, was paid to the producer. Secondly the "floor price" scheme, whereby sorghum is disposed of by agents if prices are higher than the controlled price and taken up by the Board, should the commercial price fall below the "floor" (guaranteed) price.

While supply and demand would naturally affect the merits of the two schemes the "floor" price scheme has proved the most satisfactory scheme both to the producer and consumer and it is likely that this scheme of disposal of sorghum will be permanently adopted by the Board. On prices obtained during the past year this department, as well as one of the other two Territories, prefer the "floor" price scheme.

General arrangements concerning the requirements of the Territory in both imports and exports have been expeditiously dealt with through this direct representation on both the Maize Industry and the Wheat Industry Control Boards.

9. AGRICULTURAL SHOWS

District Shows

Difficulties of communication, particularly the lack of roads, and even where roads exist the lack of transport, tend to make agricultural shows somewhat of a local nature. The majority of exhibitors are

those within walking distance of the venue, up to four or five miles. Some do make a considerable effort, travelling longer distances, and the interest in shows is gradually growing, with exhibitors coming from an ever widening area. Until communication facilities are vastly improved, however, shows cannot serve the whole farming community. In an effort to overcome this difficulty one district held three small shows at different centres, all of which were a success. This, of course, throws a big strain on the departmental field staff, for it is found that at the present time most of the organisation of such shows falls largely on the department. The question of obtaining competent judges for a large number of small shows is a difficult one.

As communities become more developed and are able to take more of the organisation of shows on their own shoulders the extension of smaller shows, covering a wider area, is an aspect of extension work which the department is keen to foster.

One show was held in each of the other districts of the territory during the year.

Gardening Competitions

In addition to their agricultural shows four districts held gardening competitions. At these there is very keen competition and the standard is high.

Central Show

A Central Show Society, composed entirely of Basuto, was formed early in the year. The committee was guided by advice from the department and ran a successful territorial show at Maseru. The show occupied two days and attracted over 1,000 exhibits and more than 5,000 visitors paid for admission. Prizewinners and their exhibits from district shows hired buses and lorries and came in to Maseru in force. They did very well and carried off some of the main prizes.

The department, during the present financial year, is developing this main show ground by erecting exhibition halls, cattle pens and stands for commercial exhibitors.

The Basutoland Central Show is now a well-established, popular and growing feature.

PART II

RESEARCH AND INVESTIGATION

1. SOIL AND CROP RESEARCH

1. General

The research work during the year has been financed from Territorial funds and from Colonial Development and Welfare Scheme (R.758). The programme of investigational work was continued in Basutoland and under the provisions of Scheme R.758, Mr. A. C. Venn, Soil Fertility Worker, carried out a small exploratory programme in Swaziland. During the year, Mr. Venn was transferred to Swaziland and Mr. A. C. Macintosh assumed control of the research programme.

Results of the work in Swaziland will be included in the report of the Department of Land Utilisation of that territory.

With virtually no industrialisation in Basutoland the Territory is entirely reliant on agriculture and migrant mine labour for its economy. Large quantities of food have to be imported, especially in dry seasons, as the internal food position is precarious.

The general level of crop yields in Basutoland is extremely low, the average on estimate being 25% of the level that can and has been obtained under prevailing field conditions. The soils of the main arable areas of the Territory have been worked out during many years of irresponsible and unenlightened husbandry so that today, in spite of a comprehensive system of physical anti-erosion devices, there remains very little in the way of soil fertility and stability.

That a series of climatically satisfactory seasons have tended to hide the seriousness of the position may in part be responsible for the prevalent apathy. The danger of the situation will require no emphasis during the period of starvation and economic stress which must follow the next adverse season.

2. Operations

The main research work was carried out on a central Experiment Station at Maseru and on six sub-stations in the districts which cover all the main climatic zones and soil types of the Territory. Operations were centralised with all work on the trials executed by the Experiment Station staff. Supplementary co-operative experiments were carried out by demonstrators on farmers' holdings.

3. Staff

A total of six staff changes during the year has had an adverse effect on progress. The Experimental Assistant resigned and a replacement was only appointed in November. The Soil Fertility

Worker, Mr. A. C. Venn, was away for five months on sick and overseas leave and, in November, was transferred to Swaziland. From May until the end of the year an Agricultural Officer, Mr. A. C. Macintosh, assumed charge of the research programme, the Maseru Experiment Station and School of Agriculture.

4. Climatic and Other Conditions. (See Table 1)

While rainfall during the winter cereal season was adequate there was a widespread infestation of aphid in wheat crops. Experiments at Berea and Leribe had to be replanted as a result of aphid attack. On the main station wheat trials were saved by aerial spraying with a systemic insecticide. Yields were, nevertheless, reduced. Many of the trace element trials with peas were damaged by unidentified pod worm.

After excessive spring rains, which delayed planting, caused abnormal erosion of top soil and led to an early loss of nitrates, the weather during the summer crop season was favourable. (See Table 1).

THE EXPERIMENTS

Few trials failed completely during the year, but the results from foothill trace element experiments were disappointing. The lack of response in many of these is related not only to the insect damage referred to above, but probably also to the substantial movement of top soil that followed the heavy spring rains, this after the trace element treatments had been applied.

In Basutoland 56 field experiments covering 2,632 plots were planted on the stations while 44 co-operative trials (564 plots) were laid out on farmers holdings. Ten exploratory experiments (314 plots) were planted in Swaziland. New ground was broken at Maseru with the starting of greenhouse pot testing. Fourteen experiments were concluded.

All experiments, except the co-operative trials, were carefully planted by hand and precisely managed. Techniques varied with trials and series. Details are given below for each project.

THE SOILS

1. MOUNTAINS AND FOOTHILLS. The soils in these regions are readily classified and examples are briefly described below.

2. LOWLANDS. The soils of the lowlands are more variable in morphology and distribution. Most types are formed from pale coloured sandstones of the Stormberg Series but two factors appear to have caused differentiation—rainfall and distance from igneous intrusions.

In the drier areas south-west of Maseru the residual soils fall into the degraded solonetz group. North-east of Maseru, with increase in rainfall, the truly residual soils are more podsollic. The mature podsol profile is, however, rarely developed.

TABLE 1
Rainfall at Maseru Experiment Station and District Plots, Basutoland
(Inches)

BASUTOLAND

Station	1957					1958												Total 1957	Mean Ann.			
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May			June	Total A	Total B
	LOWLANDS																					
Leribe	5.92	4.56	5.05	2.64	0.39	—	1.85	0.81	5.54	7.60	4.16	4.57	6.42	2.17	3.15	3.87	1.07	1.16	37.12	31.89	43.04	32.17
Berea	3.68	4.03	2.82	2.33	0.28	—	1.68	1.89	5.81	8.59	4.50	4.41	6.78	4.93	3.26	3.68	2.86	0.06	35.34	36.15	40.02	26.55
Maseru	6.18	4.55	2.53	1.61	0.22	1.12	0.55	1.46	7.11	5.21	4.34	2.44	3.49	3.26	2.23	2.73	2.63	—	31.14	23.70	37.32	27.95
Matsieng	2.39	4.34	3.04	1.86	0.17	0.80	1.38	1.65	4.37	6.09	3.78	3.22	7.41	2.57	4.56	2.32	2.88	1.35	30.70	29.95	33.09	—
Mafeteng	3.90	3.71	2.51	3.16	0.69	—	0.47	2.15	6.08	5.83	2.82	3.46	7.19	1.99	2.49	2.27	2.76	—	30.88	26.05	34.78	28.58
	FOOTHILLS																					
Machache	5.41	2.47	3.13	3.19	0.85	0.73	1.38	2.18	7.26	8.41	6.34	4.97	11.93	3.31	3.38	4.25	3.13	0.08	40.91	42.59	46.32	—
	MOUNTAINS																					
Mokhotlong	4.47	2.26	2.75	1.85	0.46	—	0.94	1.04	3.62	4.89	3.49	3.97	5.85	1.40	3.30	3.05	0.92	-	26.27	25.95	29.74	23.20
[TOTAL A													]]									
Period effective rainfall, Basutoland lowland wheat.																						
[TOTAL B													]]									
Period effective rainfall, all other crops.																						

The lowlands consist of areas of rolling hills and shallow valleys lying between discontinuous 1,000 ft. plateau. Intrusions of dolerite appear to have influenced the development of the landscape. Thus most of the rounded hills have developed as a result of resistance to erosion caused either by the hardening of country rock near dykes or by thin sill cappings, now eroded away.

The weathering products of this dolerite have markedly influenced the soil formation processes, their characteristic effect being a reduction in illuviation and the development of orange and reddish brown colours.

The soils on most of the rounded hilltops are reddish-brown in colour, deep and well drained, and with ill-defined horizons. On the flats the solonetzic or podsollic types occur, depending on the area. On the slopes in between there is usually a gradual change, varying with relief and the extent of the intrusion, from the deep red soil to the grey-brown and light brown types with clay subsoils. Brief descriptions of the soils at District Experiment Plots follow:—

Mountain Black Clay (Mokhotlong). A residual soil formed from amygdaloidal basalt. The topsoil consists of 12" of black clay merging into 17" of gravelly stony clay, lying on rotten rock. The organic matter content and base status of the topsoil are high. Structure is good and drainage free. pH increases with depth from 6.8 at surface to 7.2 in the gravel.

Foothill Red Loam (Machache). Formed from basalt on a warm aspect. The topsoil consists of 14" of reddish brown clay loam with a well developed crumb structure, pH 5.3. A discontinuous thin stone line with numerous concretions, cemented to incipient murrum in places, divides the topsoil and subsoil. The latter consists of red gravelly clay merging into spheroidally weathered basalt. Drainage is free.

Lowland Grey-Brown Sandy Loam (Solonetzic) (Maseru and Mafeteng). The topsoil consists of 18" of grey-brown fine sandy loam, pH 5.4, overlying 36" of yellowish brown mottled gravelly clay. The topsoil is low in organic matter and has weak crumb structure. Iron concretions abound at the bottom of this horizon. The clay substratum (pH 7.3) has marked columnar structure, the tops of the columns being rounded and overlain by a thin layer of fine quartz. Root penetration into the subsoil is confined to planes between columns, and drainage is poor. Periodic waterlogging and the lateral movement of water on top of the clay, leading to surface oozes, commonly occur.

Lowland Light Brown Sandy Loam (Berea). 9" light-brown structureless fine sandy loam, pH 5.4 on 12" of yellowish brown fine sandy loam with numerous small iron concretions generally distributed. Then follows a 4" band of large concretions, uncemented, in a matrix of yellow loam, lying on 8" of orange sandy clay loam with a few mottles. The parent material is whitish weathered sandstone.

TABLE 2 A (M.E. SERIES)

Maize grain in 200-lb. bags, per acre

Station	Mean Yield	Coef. of Var. %	Mean Yield		Plots Without		Linear Response				Curvatures				Linear Interactions			
			N	P	K	S.E. $\pm$	N	P	K	S.E. $\pm$	N	P	K	S.E. $\pm$	N'P'	N'K'	P'K'	S.E. $\pm$
LOWLANDS																		
Leribe	6.37	16.5	4.27	2.81	6.81	0.50	** + 4.58	** + 5.59	-0.99	0.50	+1.14	** - 4.54	-0.29	0.86	** + 2.98	0.30	+0.52	0.61
Berea	6.25	19.3	4.64	2.98	6.83	0.57	** + 2.95	** + 4.88	-0.84	0.57	-0.76	** - 5.27	+1.00	0.98	** + 2.55	-0.49	-1.55	0.70
Matsieng	12.21	7.5	11.19	9.29	12.08	0.43	** + 2.13	** + 4.10	+0.49	0.43	+0.18	** - 5.19	+0.66	0.75	** + 3.07	+0.36	+0.03	0.53
Maleteng	7.94	17.9	8.01	4.12	7.00	0.67	-0.35	** + 6.08	+1.32	0.67	-0.63	** 4.66	-1.67	1.16	+0.44	+0.28	+0.49	0.82
FOOTHILLS																		
Machache	11.64	16.4	11.85	6.56	11.77	0.90	-0.71	** + 8.94	-0.66	0.90	-0.87	* - 3.63	-1.16	1.55	* + 2.87	+0.54	+2.59	1.10
MOUNTAINS																		
Mokhotlong	15.98	12.2	15.28	15.54	15.52	0.92	+1.23	+1.04	+0.85	0.92	0.24	-1.22	-0.49	1.12	-0.24	-1.22	-0.49	1.12

TABLE 2 B (W.E. SERIES)

[illegible]

Lowland Red Sandy Loam (Leribe; Matsieng similar). 24" structureless light reddish brown fine sandy loam, pH 5.5, lying on 24" uniform orange-red fine sandy loam. The parent material is soft weathered sandstone. Drainage is free. At Matsieng the profile is deeper, no rock being encountered at 7'.

1. The N.P.K. Series

The series with nitrogen, phosphate and potash on maize and wheat was continued for the fifth season. Twelve experiments were planted at six centres.

Treatments: Factorial combinations of three rates of each of nitrogen, phosphate and potash, where per acre O=no nitrogen; N1=20 lb., N and N2=40 lb., N (as limestone ammonium nitrate), P1=25 lb., P₂O₅, P2=50 lb., P₂O₅ (as 1:1 mixture of super and raw phosphate), K1=15 lb., K₂O and K2=30 lb., K₂O (as muriate of potash).

Arrangement: 3×3×3 single replicate factorial designs.

Time and method of application: P and K for maize was drilled 2" to 3" below the seed, while N was applied six weeks after planting, placed in a band 3" from the row on the uphill side. On wheat experiments P and K were broadcast and disced in deeply before planting while the N was spread at the stooling-before-piping stage.

Plot Sizes: MAIZE: Gross 62'×21' : Nett: 58'×15'.

WHEAT: Gross 60'×15' : Nett: 54'×9'.

Spacing: MAIZE: 2' apart in 3' rows.

WHEAT: Broadcast at 40 lb. per acre in the lowlands and 90 lb. per acre in high country.

Varieties: MAIZE: American White Flint in the lowlands. S.A. 200 in the foothills and mountains.

WHEAT: White Spitzkop in the lowlands, Talberg in the foothills and mountains.

Cultivation: MAIZE: Two hand and two implement cultivations.

WHEAT: None.

Results: See Tables 2A and 2B.

Discussion (NPK Series): By Basutoland standards yields at most centres were good. The mean yield of the hybrid variety (S.A. 200) deserves attention. Coefficients of variation were higher than usual.

Effects and interactions follow the pattern of previous years.

On all soils except the mountain black clay, linear responses to P are large. If the accumulation of phosphates on P plots through the years is responsible for the size of the negative curvature responses in the maize experiments, it appears that wheat does not make the same use of residual fertiliser.

Responses to N are inconsistent but the large significant NP interactions at four centres are worthy of note. This point receives further attention in the section on nitrogen manuring that follows. The soils of Basutoland are not deficient in potash and added potassic fertilisers have no effect on crop yields.

2. NITROGEN STUDIES

Nine experiments designed to throw more light on the question of nitrogen manuring were laid down.

(1) Rates of Phosphate and Nitrogen in Relation to Plant Population

Five maize trials were planted in the districts on sites of previous NPK experiments. In the case of phosphates, therefore, the treatments include a substantial component of residual effect.

Arrangement: Single replicate $3 \times 3 \times 3$ factorial designs.

Treatments: (Rates given per acre):

N0=No nitrogen	P0=No phosphate	S0=Plants $3' \times 24''$
N1=20 lb. N	P1=25 lb. P_2O_5	S1=Plants $3' \times 18''$
N2=40 lb. N	P2=50 lb. P_2O_5	S2=Plants $3' \times 12''$

The S2 espacement gives a population of approximately 14,800 plants per acre. N was applied as Nitramoncal and P as a 1:1 mixture of superphosphate and raw Moroccan rock phosphate.

Application: P drilled at planting; N applied at six weeks as a side dressing.

Varieties: LOWLANDS: American White Flint. MACHACHE: S.A. 200.

Results: See Table 3.

(2) Rates of Nitrogen in Relation to Time Application and Plant Population

Two identical trials were continued on the main station on areas of grey-brown sandy loam and red sandy loam typical of the main soil types occurring in the lowlands.

Arrangement: $4 \times 4 \times 2$ factorial designs in 2 blocks of 16 plots. 3 replicates.

Treatments (Rates are per acre):

N0=No nitrogen	S3=Plants $3' \times 6''$	T1=Applied at 6 weeks
N1=20 lb. N	S2=Plants $3' \times 12''$	T2=Half at 6 weeks
N2=40 lb. N	S1=Plants $3' \times 18''$	Half at tasseling
N3=60 lb. N	S0=Plants $3' \times 24''$	

Application: N as "Nitramoncal" placed in $3''$ band $3''$ from row.

Basal: 300 lb. superphosphate per acre.

Variety: American White Flint.

Results: See Tables 4 and 5.

TABLE 3

(RATES OF N, P AND PLANT POPULATIONS)
Maize grain in 200-lb. bags per acre

Station	Soil	Coef. of Mean Yield Var. %	Mean yields				Linear Response				Curvatures				Linear Interactions			
			NO	PO	SO		N	P	S	S.E. $\pm$	N	P	S	S.E. $\pm$	N/P'	N'S'	P'S'	S.E. $\pm$
LOWLANDS																		
Leribe	Rsl	8.10 21.1	5.10	5.58	8.84		** + 5.84	** + 3.89	*	0.81		*	- 1.91	1.40	** + 3.19	- 0.42	0.70	0.99
Berea	Bsl	6.74 29.8	3.40	2.57	6.76		** + 6.10	** + 5.84	0.99	0.95		**	- 2.81	1.64	** + 4.63	+ 0.76	- 0.94	1.16
Matsieng	Rsl	18.51 8.1	17.16	14.82	15.65		* + 1.79	** + 5.58	** + 6.20	0.71		**	+ 1.46	1.22	* + 1.89	+ 1.60	*	0.87
Maleteng	G-bsl	8.60 23.1	8.40	6.42	8.99		+ 1.21	** + 3.40	- 0.64	0.94			+ 0.43	1.62	* + 3.67	+ 1.61	1.27	1.15
FOOTHILLS																		
Machache	R1	20.30 7.1	20.47	15.20	16.70		- 0.52	** + 9.03	** + 7.50	0.68		*	+ 1.03	1.18	+ 0.97	+ 0.99	+ 1.25	0.84

* = Significant at P = 0.05.

** = Significant at P = 0.01.

Soils: Rsl = Red sandy loam.

G-bsl = Grey brown sandy loam.

R1 = Foothill red loam.

Bsl = Light brown sandy loam.

TABLE 4 (GREY-BROWN SANDY LOAM)

Maize grain in 200-lb. bags per acre

	S0	S1	S2	S3	Mean	
N0	7.74	4.34	4.68	2.79	4.89	S.E. ± 0.25 S.E. all figures ± 0.51
N1	11.38	7.89	7.86	4.85	7.98	
N2	13.86	11.66	9.84	7.48	10.71	
N3	16.99	13.76	14.55	10.69	14.00	
Mean	12.49	9.40	9.23	6.45	9.39	
S.E.	± 0.25					

	N0	N1	N2	N3	Mean	
T1	5.26	8.25	10.84	13.55	9.48	S.E. ± 0.22 S.E. all figures ± 0.45
T2	4.51	7.72	10.59	14.44	9.32	
Mean	4.89	7.98	10.71	14.0	9.39	
S.E.	± 0.25					

TABLE 5 (RED SANDY LOAM)

Maize grain in 200-lb. bags per acre

	S0	S1	S2	S3	Mean	
N0	6.76	4.33	4.61	3.94	4.91	S.E. ± 0.29
N1	10.40	8.54	6.60	5.89	8.59	
N2	11.42	10.83	9.41	8.69	9.98	
N3	13.09	13.46	12.64	11.02	12.55	
Mean	10.42	9.29	8.32	8.01	9.01	S.E. cell figures ± 0.58
S.E.	± 0.29					

	N0	N1	N2	N3	Mean	
T1	4.74	7.63	9.67	12.64	8.67	S.E. ± 0.20
T2	5.08	8.09	10.51	12.47	9.04	
Mean	4.91	7.86	10.09	12.56		S.E. cell figures ± 0.41

S.E. ± 0.29

(3) Form of Nitrogen and Method of Application

The experiment comparing conjoint and separate applications of N and P was continued at Maseru. In the light of American work it was considered that the supplying of N in the form of a fertiliser mixture might increase uptake of P and affect yields.

Treatments: All plots received superphosphate at the rate of 200 lb. per acre (50 lb. P_2O_5 per acre) whether or not the nitrogenous fertiliser was mixed with it.

- (1) No nitrogen.
- (2) 40 lb. N per acre in a mixture drilled at planting.
- (3) 40 lb. N per acre side dressed.
- (4) 20 lb. N per acre as a mixture drilled at planting plus 20 lb. N per acre side dressed.

For treatments (2) to (4) N supplied as sulphate of ammonia versus N supplied as Nitramoncal.

Arrangement: Randomised blocks. *Spacing:* 3' × 12".

Variety: A.W.F. *Soil:* Grey-brown sandy loam, pH 5.4.

Results: See Table 6.

TABLE 6 (FORM AND METHOD OF N FERTILIZING)
Maize grain in 200-lb. bags per acre

<i>Method of Application</i>	<i>Form of N</i>	<i>Mean Yield</i>	<i>Mean</i>
(1) No nitrogen applied	—	6.23	6.23
(2) Applied as a mixture	Sulph. Amm. Nitramoncal	11.55 10.32	10.94 —
(3) Half as a mixture plus half side dressed	Sulph. Amm. Nitramoncal	10.86 11.40	11.13 —
(4) Side dressed	Sulph. Amm. Nitramoncal	12.56 13.00	12.78 —
Mean yield		10.84	
S.E. mean yield		±0.66	
L.S.D. (5%)		1.93	
Variance ratio		11.35	
F. requirement		2.42	
Coef. of var. %		14.9	

Discussion: All nitrogen treatments significantly increased yields. Eliminating forms of N, there was no difference due to method of application.

(4) Nitrogen and Monoculture

The experiment testing the possibility that a high level of maize production can be maintained over a long period in a system of monoculture using no organic manures was continued. The essence of the theory is that, given sufficient carbohydrate in the form of crop residues, nitrogen supplied as fertilizer can be converted into a more stable and effective organic form. To make maximum use of this N the plant population must be as high as soil moisture conditions permit.

Treatments: (a) WHOLE PLOTS—WINTER TREATMENTS:

O=No stover (removed) and no nitrogen.

N1+S=20 lb. N per acre plus plot stover ploughed in.

N2+S=40 lb. N per acre plus plot stover ploughed in.

N1 =20 lb. N per acre ploughed in without stover.

N2 =40 lb. N per acre ploughed in without stover.

(b) SUB PLOTS—SUMMER TREATMENTS:

O=No nitrogen side dressed.

Side N1=20 lb. N per acre side dressed at 6 weeks.

Arrangement: Randomised blocks with split plots.

Basal: 400 lb. supers per acre. *Variety:* A.W.F.

Plant Population: 15,000 per acre. *Soil:* Grey-brown sandy loam.

Results: See Table 7.

TABLE 7 (NITROGEN AND MONOCULTURE)
Maize grain in 200-lb. bags per acre

Winter Treatments	Summer side dressing				Means	
	O		N1		1957	1958
	1957	1958	1957	1958		
O	6.47	2.01	10.62	3.56	8.55	2.78
N1	15.09	5.33	16.72	6.38	15.90	5.85
N2	19.64	7.23	19.52	7.29	19.58	7.25
N1+S ...	12.77	4.63	14.90	5.75	13.84	5.19
N2+S ...	11.0	7.13	20.11	7.56	18.56	7.34
S.E.	±1.12	±0.34	±1.12	±0.34	±1.03	±0.30
Mean	14.19	5.26	16.37	6.11	15.28	5.69
S.E.		±0.15		±0.15		

Nitrogen and Grass Leys: An experiment was started at Maseru to test the efficacy of the system of building up soil fertility by means of heavily fertilized grass leys.

Initially various rates of nitrogenous fertilizer are tested on *Eragrostis curvula*.

Treatments and Results: See Table 8.

Arrangement: Six randomised blocks. *Basal:* 300 lb. supers per acre.

Fertilizer: All N supplied as "Nitramoncal".

TABLE 8
Air-dry hay in tons per acre

Treatment		Mean Yields		
		1st Cutting	2nd Cutting	Total
N0=No nitrogen	...	0.28	1.62	2.64
N1=30 lb. N per acre	...	0.54	1.46	2.60
N2=60 lb. N per acre	...	0.89	0.85	1.77
N4=90 lb. N per acre	...	0.92	0.61	1.50
N4=120 lb. N per acre	...	1.01	0.56	1.10
N5=150 lb. N per acre	...	1.14	0.14	0.70
Mean	...	0.80	0.92	1.72
S.E. mean yields	...	0.06	0.04	0.08
L.S.D. (5%)	...	0.16	0.10	0.23
Var. ratio	...	32.7	196	101
F. requirement	...	2.6	2.6	2.6
Coef. of var. %	...	17.3	9.5	11.2

Discussion (NITROGEN EXPERIMENTS):

Nitrogen and Spacing: In the maize trials a spacing of 3'×2' (S0) was taken as standard on the assumption that at this population density (7,000 plants per acre) added nitrogen will normally not affect yields. During the previous four years there were positive N effects from only 8 of 27 lowland trials in which N was applied to maize planted 3'×2'. No responses to N have been recorded in the foothills (11 results).

During the report year, however, nitrogenous fertilizer improved yields on all six sites in the lowlands, irrespective of plant population. In contrast to previous results there were no interactions between nitrogen and spacing. In four cases yields were reduced by increasing the plant density, even in the presence of added N.

The conclusion is drawn that, while under normal rainfall conditions soil nitrate supplies meet the requirements of 7,000 plants per acre but not those of 15,000, during the unusually wet season under review there was insufficient mineralised nitrogen for even 7,000 plants per acre. This is attributed to leaching and/or the impediment of mineralisation under conditions of excessive soil moisture. It can be further concluded that larger amounts of fertilizer N could profitably have been used. Rainfall exceeded the average mainly in the spring and it may be considered reasonable to recommend heavier side dressings on the light lowland soils whenever rainfall early in the season is excessive.

On the heavier foothill soil nitrate supply was apparently not a limiting factor. Results from three seasons show that plant density can be increased to 15,000 plants per acre with considerable advantage in this region.

Phosphate: There were the usual responses to added phosphate and consistent NP interactions in the lowlands. Averaging the results from the four experiments the following pattern is obtained:—

	P0	P2
N0 ...	7.9	8.6 (bags/acre).
N2 ...	7.2	14.7

Time of application: The time of application of nitrogenous fertilizer is relatively unimportant. Results to date indicate that, taking all factors into consideration, six weeks after planting is the best time.

Type of fertilizer: Nitramoncal and sulphate of ammonia are equally effective in any one season. The use of the latter should be discouraged because of the poor base status and acidity of the lowland soils.

Maize monoculture based on fertilizers (Table 7): All winter nitrogen treatments increased yields, which were, nevertheless, low. The effect of summer side dressing was small but significant. No conclusions can be drawn at this stage.

Nitrogen for grass: The results in Table 8 are in line with those obtained in South Africa. Responses in the succeeding years of the experiment can be expected to be larger.

3. PHOSPHATE

The experiment on forms and rates of phosphatic fertilizer was continued at Maseru, with beans.

Arrangement: 7 randomised blocks of 10 plots each.

Soil: Grey-brown sandy loam.

Treatment: See Table 8.

Application: Supers and the 1:1 mixture drilled at planting. Other forms broadcast in winter and ploughed in. *Variety:* Small white haricot.

Results: See Table 9.

TABLE 9 (FORMS AND RATES OF P)
Bean grain in 200-lb. bags per acre

Treatment (Rates per Acre)							Mean Yield
B2=200 lb. basic slag	...	...	...	...	...	...	3.92
B1=100 lb. basic slag	...	...	...	...	...	...	3.82
SR1=100 lb. 1:1 mixture of supers and rock	...	...	...	...	...	...	3.66
R1=100 lb. raw Moroccan rock	...	...	...	...	...	...	3.56
S1=100 lb. superphosphate	...	...	...	...	...	...	3.38
S2=200 lb. superphosphate	...	...	...	...	...	...	3.35
2=600 lb. "Langfos"	...	...	...	...	...	...	3.28
SR2=200 lb. 1:1 mixture	...	...	...	...	...	...	3.21
R2=200 lb. raw Moroccan rock	...	...	...	...	...	...	3.16
L1=300 lb. "Langfos"	...	...	...	...	...	...	3.09
Mean							3.44
S.E. mean yields							±0.19
L.S.D. (5%)							0.53
Var. ratio							14.41
F. requirement							2.05

Discussion: Yields were fair only. Root nodulation was poor in spite of inoculation. Beans are a very variable crop in Basutoland and a high degree of precision in bean experiments is rarely obtained.

The superiority of basic slag is demonstrated. With previous maize crops both basic slag and raw rock phosphate have proved more effective than the other types.

4. POTASH

The annual experiment on rates of muriate of potash was discontinued.

5. LIMING

(1) Lime, Manure and Fertilizers

The trials at Machache (red loam, pH 5.3) and Maseru (grey-brown sandy loam, pH 5.4) were continued with maize.

Treatments: Factorial combinations of three rates of total P_2O_5 applied as kraal manure (D0, D1 and D2), three (the same) rates of total P_2O_5 applied as 1:1 super-raw rock phosphate fertilizer (P0, P1 and P2), and three rates of high carbonate agricultural lime (L0, L1 and L2), where:—

D0=No kraal manure.

D1=Kraal manure in quantity to give 25 lb. P_2O_5 per acre.

D2=Kraal manure in quantity to give 50 lb. P_2O_5 per acre.

P0=No phosphate fertilizer.

P1=25 lb. P_2O_5 per acre as 1:1 mixture.

P2=50 lb. P_2O_5 per acre as 1:1 mixture.

L0=No agricultural lime per acre.

L1 =3,000lb.agricultural (calcitic)lime per acre. L2= 6,000 lb. lime.

Manure is applied to D plots every 3 years, fertilizer being applied in other years. A rotation of maize, maize beans is followed. Manure was last applied for the 1956 crop.

Arrangement: Two replicate $3 \times 3 \times 3$ designs. *Varieties:* A.W.F. at Maseru, S.A. 200 at Machache.

Results: See Tables 10 and 11.

TABLE 10 (MANURE, PHOSPHATE AND LIME)

Maize grain in 200-lb. bags per acre

(FOOTHILL RED LOAM)

		<i>P as Fertilizer</i>			<i>L0</i>	<i>Lime L1</i>	<i>L2</i>	<i>Mean</i>
		<i>P0</i>	<i>P1</i>	<i>P2</i>				
P. as manure	D0	10.69	16.63	17.32	10.54	16.31	17.79	14.88
	D1	13.10	16.51	19.43	12.92	17.22	18.89	16.34
	D2	16.41	17.85	19.79	14.48	19.14	20.14	18.02
Mean		13.40	17.00	18.85	12.65	17.56	19.04	
		<i>L0</i>	<i>Lime L1</i>	<i>L2</i>	S.E. means = ± 0.38 S.E. cell figures = ± 0.66			
P as fertilizer	P0	8.89	13.90	17.46				
	P1	13.27	18.43	19.30				
	P2	15.79	20.34	20.41				

TABLE 11 (MANURE, PHOSPHATE AND LIME)
Maize grain in 200-lb. bags per acre
(GREY-BROWN SANDY LOAM)

		<i>P as fertiliëer</i>				<i>Lime</i>		
		<i>P0</i>	<i>P1</i>	<i>P2</i>	<i>L0</i>	<i>L1</i>	<i>L2</i>	<i>Mean</i>
P as manure	D0	9.60	11.47	8.91	9.28	10.74	9.96	9.99
	D1	10.96	10.06	9.71	9.48	10.97	10.27	10.24
	D2	12.33	11.24	11.43	12.07	11.68	11.24	11.66
Mean		10.96	10.92	10.02	10.28	11.13	10.49	
		<i>Lime</i>			S.E. means = ± 0.48			
		<i>L0</i>	<i>L1</i>	<i>L2</i>	S.E. cell figures = ± 0.82			
P as fertilizer	P0	10.44	11.00	11.45				
	P1	10.99	11.20	10.57				
	P2	9.41	11.20	9.45				

Discussion: The site of the Maseru experiment was waterlogged during the Spring. Because plant losses were high in one section the results from a single replicate only are presented for this trial. The crop at Machache was good.

At Maseru the only significant result was the small response to manure (second year residual). The chlorosis that was common on L2 plots is not reflected in the yields.

The results from Machache follow the pattern of previous years, viz. large responses to P and D and an even bigger lime effect.

The fact that a dressing of 3 tons of lime per acre on this soil can continue to increase maize yields to the extent of over 1,600 lb. of grain per acre, four years after the lime is applied, is of great importance.

None of the interactions is significant. Changes in pH are reflected in figures below:—

				<i>Foothill red loam</i>			<i>Grey-brown sandy loam</i>		
				1953	1956	1958	1953	1956	1958
D0	P0	L0	...	5.4	5.4	5.3	5.5	5.4	5.4
D0	P0	L1	...	5.5	6.0	6.3	5.5	6.2	6.4
D0	P0	L2	...	5.4	6.1	6.8	5.5	6.4	7.0
D2	P0	L2	...	5.4	6.1	6.7	5.5	6.3	6.9
D0	P2	L2	...	5.4	6.3	6.8	5.5	6.4	7.0
D2	P2	L2	...	5.4	6.2	6.8	5.5	6.4	7.1

(2) Rates of Lime

Two simple experiments comparing five rates of agricultural lime were continued at Berea and Matsieng.

Treatments: See Tables 12 and 13.

Arrangement: At Matsieng a 5 $\times$ 5 Latin square. At Berea randomised blocks.

Maize Variety: A.W.F. *Soils:* At Matsieng a red sandy loam. At Berea a pale brown sandy loam. *Basal:* 200 lb. superphosphate per acre.

Results: See Tables 12 and 13.

TABLE 12 (PALE BROWN SANDY LOAM)
Mean yields of grain in 200-lb. bags per acre

Year	...	...	1954	1955	1956	1957	1958
Crop	...	...	Maize	Maize	Maize	Beans	Maize
<i>Lime rate</i>							
None	...	...	11.09	5.76	4.06	2.17	10.40
1,000 lb.	...	...	12.20	6.52	4.46	2.13	11.19
2,000 lb.	...	...	12.05	6.46	4.93	4.17	11.02
3,000 lb.	...	...	10.58	6.92	4.16	4.48	7.31
4,000 lb.	...	...	10.09	5.83	4.05	4.38	3.66
Mean	...	...	11.20	6.30	4.33	3.67	8.72
S.E. mean yields	±		0.69	0.43	0.21	0.33	0.68
Var. ratio	...	...	1.76	1.34	2.62	9.18	22.90
F. reqmt.	...	...	3.26	3.26	3.26	3.26	3.26

TABLE 13 (RED SANDY LOAM)
Mean yields of grain in 200-lb. bags per acre

Year	...	...	1954	1955	1956	1957	1958
Crop	...	...	Maize	Maize	Maize	Beans	Maize
<i>Lime</i>							
None	...	...	9.55	7.45	3.21	3.02	15.53
1,000 lb.	...	...	11.42	7.37	3.05	3.31	15.51
2,000 lb.	...	...	12.06	7.76	3.95	3.54	17.34
3,000 lb.	...	...	12.72	8.29	4.81	3.63	16.28
4,000 lb.	...	...	12.90	8.26	4.63	3.46	16.41
Mean	...	...	11.73	7.83	3.93	3.39	16.13
S.E. mean yields	±		0.42	0.47	0.36	0.19	0.60
Var. ratio	...	...	11.19	0.10	5.05	2.62	1.05
F. reqmt.	...	...	3.26	3.26	3.26	3.26	3.26

Discussion: On the pale brown soil the crops on plots that had received 1½ and 2 tons of lime per acre (in 1953) suffered severely from iron chlorosis, a phenomenon that, though appearing in previous years, has not hitherto been reflected in the yields. The results from the red soil show no significant differences.

Changes in pH at these sites are shown below:—

	<i>Pale-brown sandy loam</i>			<i>Red sandy loam</i>		
	1954	1956	1958	1954	1956	1958
L0	5.4	5.4	5.5	5.5	5.5	5.4
L1	6.0	5.9	6.4	5.7	5.7	5.5
L2	6.3	6.0	6.6	5.9	5.8	5.7
L3	6.8	6.2	7.1	6.1	6.0	6.3
L4	7.0	6.3	7.2	6.2	6.0	6.6

(3) Types of Lime

Experiments on areas of red and grey-brown soil were continued. The crop was beans.

Treatments: Types and rates of lime, applied in July, 1956, where per acre:—

0=No lime.

1 Mg=1 ton dolomitic lime, 1 Ca=1 ton calcitic lime.

2 Mg=2 tons dolomitic lime, 2 Ca=2 tons calcitic lime.

3 Mg=3 tons dolomitic lime, 3 Ca=3 tons calcitic lime.

P=50 lb. P_2O_5 as superphosphate.

D=50 lb. P_2O_5 as manure.

Arrangement: Randomised blocks with split plots.

Basal: Nil. *Bean variety:* Small white Haricot.

Results: See Tables 14 and 15.

TABLE 14 (GREY-BROWN SANDY LOAM)

Bean grain in 200-lb. bags per acre

	0	1 Mg	2 Mg	3 Mg	1 Ca	2 Ca	3 Ca	Mean
P	3.75	5.33	S.E. $\pm$	± 0.72				4.68
	4.17	5.70	4.83	4.61	5.14	5.12	3.75	+0.14
D			4.79	5.57	4.48	4.30	5.36	4.75
Mean	3.96	5.51	4.81	5.09	4.81	4.71	4.55	4.72

S.E. ± 0.68

TABLE 15 (RED SANDY LOAM)

Bean grain in 200-lb. bags per acre

	0	1 Mg	2 Mg	3 Mg	1 Ca	2 Ca	3 Ca	Mean
P	3.87	5.87	S.E. $\pm$					5.22
	4.30	7.03	5.34	5.90	4.64	5.84	5.48	± 0.28
D			5.80	5.73	5.90	6.53	5.25	5.72
Mean	4.08	6.45	5.57	5.81	5.27	6.18	5.36	

S.E. ± 0.40

S.E. horizontal comparisons ± 0.56

S.E. vertical comparisons ± 0.60

Discussion: The yields of both crops were good. On the grey-brown soil yield differences due to treatments are not significant as a result of the creep of lime effects down the slope referred to in the report for 1957. Lateral subsurface water movement in these solonchic soils is marked.

On the red soil all rates of lime increased yields but no statistical significance can be attached to differences between rates and types.

Again, where severe chlorosis was induced by 2 and 3 ton applications in a previous maize crop, beans were not so affected.

Both trials will be abandoned and a fresh start made on new sites on which plots will be surrounded by drains to prevent the movement of moisture from one plot to another.

6. TRACE ELEMENTS

By the end of the 1956/57 season there remained various unsolved crop problems and experimental results to which no satisfactory interpretation had been attached, the solution of which probably lay in trace element nutrition. These are summarised below:—

- (1) The remarkable effect on yields of liming the foothill red loams and the poor growth of wheat on these soils even when heavily fertilized.
- (2) The yellowing in maize in certain areas in the lowlands, not always rectifiable by nitrogen fertilizing.
- (3) The difficulty experienced in obtaining good root nodulation on legumes and the beneficial effect on beans of liming.
- (4) The chlorosis induced in cereals by liming the grey-brown soils of the lowlands.
- (5) The poor growth of perennial pasture legumes, a phenomenon widespread over Southern Africa and not always explicable in terms of moisture.

A number of field experiments with trace elements had been carried out in previous years but from only one had a significant result been obtained (responses in maize on a foothill red loam to Mn and a B-Mo mixture).

During the year under review more attention was paid to trace element problems and a larger field programme was supplemented by greenhouse pot experiments.

6A. POT EXPERIMENTS

Nutrient rooms and a greenhouse were erected on the Maseru Station. The latter was a prefabricated type with a skin of PVC.

Pot experiments were commenced in November, 1957. The writer was off duty during February, 1958, following an accident and, at the end of March the greenhouse was damaged beyond repair in a severe storm, the experiments then in progress being ruined. The results given below, therefore, are those obtained during that short period after the development of a suitable technique and routine and before the final mishap.

Technique: The technique used was basically that developed by Dr. E. M. Chenery, in Uganda, with various modifications.

For each experiment 75 polythene-lined cans were each filled with 400 g. air dry soil and leached for three days to reduce nitrate contents. After the germination of the test plants the pots were grouped into five blocks, the 15 weakest plants allocated to the fifth block. A colour code was used to differentiate treatments.

Thirteen nutrient solutions, each lacking one essential nutrient or group of nutrients, were made up, together with solution of complete nutrients and one of phosphate. These were based on the Long Ashton formula but with iron omitted and a higher molybdenum concentration. Within the limits of resources suitable materials and methods were used to ensure purity.

Solutions were applied daily for six weeks with phosphate added to appropriate pots thrice during the first three weeks. After six weeks the plants were cut off, air dried (in the absence of suitable oven) and weighed.

It was usually the case that some plants in the fifth block died and the results presented are those from four replicates.

Results and Discussion (See Table 16):

The figures for six preliminary trials are not presented because of the plant losses that occurred as a result of overheating in the greenhouse. They nevertheless yielded valuable information. There were two trials with tomatoes on each of three soils: a lowland grey-brown sandy loam (ex sandstone), a red sandy loam (sandstone and dolerite) and a foothill red loam (basalt). Without exception plants in pots that had not received one of N, P, S or Mo died back under the conditions of excessive temperature. Numerous other plants died but in an inconsistent pattern. A system of partial shading was subsequently introduced.

The results set out in Table 16 are equally interesting. Because biometrically a single plant represented a plot, variance analysis of the weights gives high variation coefficients and yields little additional information. It is the study of the growing plant that gives the best indication of deficiencies. Nevertheless the weights in nearly every case support the deficiency symptoms observed.

(1) *Sulphur*: On every soil tested except that from Stegi and irrespective of the type of test crop used, marked sulphur deficiency symptoms developed in plants growing in pots that had not received added sulphates.

Theories arising out of this startling result must remain tentative at this stage. During the report year sulphur as a treatment figured in only one field trial, which failed. The possibility exists that either the deficiencies were induced in the greenhouse by reduction of sulphates in conditions of excessive soil moisture (improbable) or that the symptoms developed from physiological disturbances caused by high N concentrations or N-S imbalance.

(2) *Molybdenum*: A deficiency of molybdenum was recorded in all the soils tested when the test crop was tomatoes. Negative results were obtained with maize and groundnuts.

A certain amount of confirmation of a general molybdenum deficiency in the Basutoland lowlands and foothills is available from field trials, this in a mass of negative data. The results must be considered of the greatest significance for local agriculture.

(3) *Zinc*: Soils (3) and (4) were taken from areas on which a growing maize crop was suffering from "yellowing", a "disease" which has received much attention in South Africa and which has been diagnosed as a zinc deficiency. In the pot experiments only slight possible zinc deficiency symptoms were observed in "no zinc" plants but these were not supported by the weights. On the other hand "no sulphur" plants developed severe chlorosis. One must conclude that "yellowing" in maize on this soil is either caused by a deficiency of available sulphates or that there was a technological weakness in the experiments that precluded the demonstration of zinc deficiency. The latter is entirely possible. The "no trace element" solution was suspect.

TABLE 16
POT TESTS
Mean plant weight (dry matter) per pot in grammes

Experiment No. ... Test Crop ...	Basutoland				Swaziland			
	1 Maize	2 Maize	3 Maize	4 G'nd. nuts	5 To- mato	6 To- mato	7 To- mato	8 To- mato
<i>Treatment</i>								
Complete nutrients ...	0.99	3.05	2.42	2.24	0.65	0.80	1.19	0.44
No ₃ omitted... ..	1.64	2.49	1.61*	3.23	0.88	0.54	0.87	0.44
N omitted	0.95*	0.76*	1.11*	0.76*	0.44	0.28*	0.81	0.40
P omitted	0.93*	1.73*	1.43*	1.73	0.04*	0.03*	0.03*	0.03*
K omitted	1.44	2.46	1.79	2.22	0.54	0.57	0.49*	0.45
Ca omitted	1.26	2.42	2.10	2.44	0.77	0.60	1.58	0.45
Mg omitted	0.96	2.14	2.27	2.52	0.21	0.53	1.32	0.41
S omitted	0.87*	1.03*	1.59*	1.71*	0.08*	0.52*	0.41*	0.43
Trace elements omitted	0.86*	2.79	2.02	2.08	0.35	0.36*	0.72	0.28*
B elements omitted	2.24	2.60	2.43	2.16	0.44	0.27*	1.42	0.45
Cu elements omitted	1.54	2.75	2.38	1.72	0.32	0.64	0.77	0.41
Mn elements omitted	1.25	2.35	2.24	2.23	0.51	0.62	1.50	0.34
Mo elements omitted	1.10	2.79	1.84	1.92	0.03*	0.54*	0.93*	0.26*
Zn elements omitted	1.10	2.43	2.12	1.95	0.29	0.71	0.75	0.43
All elements omitted	0.69*	0.91*	0.64*	0.66*	0.02*	0.03*	0.05*	0.03*
Mean weight ...	1.19	2.18	1.86	1.97	0.37	0.47	0.86	0.35

*—Treatments all plants which showed obvious deficiency symptoms.

SOIL DATA

No.	Centre	Description	pH	Parent material
1	Berea }	Pale brown sandy loam	7.2	Sandstone
2	Berea }	(See page 4). Soil 1 overlimed in 1953	5.4	"
3	Maseru }	17" grey-brown sandy loam on yellow clay		"
4	Maseru }	Typical degraded so.onetz	5.4	"
5	Machache }	14" ferruginous red clay loam merging		
6	Machache }	into gravel with incipient murram on rotten basalt	5.5	Basalt
7	Goedgegun	Deep lateritic red clay loam	5.4	Granite
8	Stegi	Deep, fertile, chocolate-coloured clay loam	6.0	Grano- phyre

Thirteen nutrient solutions, each lacking one essential nutrient or group of nutrients, were made up, together with solution of complete nutrients and one of phosphate. These were based on the Long Ashton formula but with iron omitted and a higher molybdenum concentration. Within the limits of resources suitable materials and methods were used to ensure purity.

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P omitted ...	0.93*	1.73*	1.43*	1.73	0.04*	0.03*	0.03*	0.03*
K omitted ...	1.44	2.46	1.79	2.22	0.54	0.57	0.49*	0.45
Ca omitted ...	1.26	2.42	2.10	2.44	0.77	0.60	1.58	0.45
Mg omitted ...	0.96	2.14	2.27	2.52	0.21	0.53	1.32	0.41
S omitted ...	0.87*	1.03*	1.59*	1.71*	0.08*	0.52*	0.41*	0.43
Trace elements omitted	0.86*	2.79	2.02	2.08	0.35	0.36*	0.72	0.28*
B elements omitted	2.24	2.60	2.43	2.16	0.44	0.27*	1.42	0.45
Cu elements omitted	1.54	2.75	2.38	1.72	0.32	0.64	0.77	0.41
Mn elements omitted	1.25	2.35	2.24	2.23	0.51	0.62	1.50	0.34
Mo elements omitted	1.10	2.79	1.84	1.92	0.03*	0.54*	0.93*	0.26*
Zn elements omitted	1.10	2.43	2.12	1.95	0.29	0.71	0.75	0.43
All elements omitted	0.69*	0.91*	0.64*	0.66*	0.02*	0.03*	0.05*	0.03*
Mean weight ...	1.19	2.18	1.86	1.97	0.37	0.47	0.86	0.35

*—Treatments all plants which showed obvious deficiency symptoms.

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6	Machache }	into gravel with incipient murram on rotten basalt ...	5.5	Basalt
7	Goedgegun	Deep lateritic red clay loam ...	5.4	Granite
8	Stegi	Deep, fertile, chocolate-coloured clay loam ...	6.0	Grano- phyre

(4) *Nitrogen, Phosphate and Potash*: The results were as anticipated. The indication of K deficiency at Goedgegun in Swaziland will be followed up in the field.

6B. TRACE ELEMENT FIELD EXPERIMENTS

(1) On Foothill Red Loams

STATION TRIALS

Four experiments with trace elements were laid out on the main substation at Machache.

(A) OBSERVATION TRIAL

Long plots of the following crops were traversed by "vertical" treatment strips: Potatoes, peas (two varieties), beans, cabbages, carrots and hairy vetch.

- Treatments*: (1) No trace elements applied.
 (2) Molybdenum trioxide at 4 oz. per acre.
 (3) Borax at 10 lb. per acre.
 (4) Manganese sulphate at 15 lb. per acre.

Results: Tests of significance could not be applied. Observations supported by the weights of produce showed no apparent effect from Mo and Mn while B depressed the yields of the legumes and carrots.

(B) TRACE ELEMENTS FOR BEANS

Treatments: See Table 17.

Arrangement: 2⁵ factorial design in 4 blocks. *Basal*: 300 lb. superphosphate per acre. *Variety*: Small white Haricot. *Application*: Salts mixed with basal, broadcast and disced in.

Results: See Table 17.

TABLE 17
Bean grain in 200-lb. bags per acre

<i>Treatment (weight per acre)</i>				<i>Mean Response</i>
Zn.	Zinc sulphate	...	15 lb.	-0.37
Mg.	Magnesium sulphate	...	50 lb.	+0.38
Mn	Manganese sulphate	...	15 lb.	-0.08
B	Borax	...	10 lb.	-0.28
Mo	Sodium molybdate	...	4 oz.	+0.08
Mean yield 4.3 S.E.				±0.23

Discussion: Neither main effect nor interactions were significant. During the early part of the season there was considerable erosion of the topsoil and movement of soil from one plot to another.

(C) TRACE ELEMENTS FOR MAIZE

The trial commenced in 1956 was continued, with treatments applied for a second time.

Treatments: Factorial combinations of the presence and absence of Cu, Zn, Mg, Mn and Mo where, per acre:—

Cu=15 lb. Copper sulphate.

Zn=15 lb. Zinc sulphate.

Mg=50 lb. Magnesium sulphate.

Mn=15 lb. Manganese sulphate.

Mo=4 oz. Molybdenum trioxide.

Arrangement: 2⁵ factorial design in 4 blocks. *Basal:* 200 lb. superphosphate plus 200 lb. nitramoncal plus 100 lb. muriate of potash per acre. *Variety:* S.A. 200 (maize).

Results: See Table 18.

TABLE 18
Maize grain in 200-lb. bags per acre

Factor	Mean Resp.	Response with									
		Cu		Zn		Mg		Mn		Mo	
		Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.
Cu	-0.32	—	—	0.26	-0.89	-0.69	0.05	-1.02	0.39	-0.53	-0.10
Zn	-1.17	-0.59	-1.74	—	—	-0.85	-1.49	0.15	-2.49	-1.26	-1.08
Mg	0.43	0.07	0.80	0.76	0.11	—	—	0.47	0.40	0.14	0.73
Mn	+0.70	—	1.41	2.03	-0.62	0.74	0.67	—	—	1.93	-0.52
Mo	+1.03	0.81	1.24	0.93	1.12	0.73	1.32	2.25	-0.20	—	—
S.E.	±0.77	S.E. ±1.09									

Discussion: While the mean responses to Mo and Mn are not statistically significant these elements have produced the largest positive effects. In 1957 both increased yields significantly.

The interactions Mo—Mn and Zn—Mn attain significance this year. Thus both Mo and Mn were effective only in the presence of the other of the pair and Mn in the presence of Zn.

Although the increments are small the fact that the crop was maize and not one more susceptible to micro-nutrient deficiencies adds interest to the results. Present Season experiments are designed to provide more information on the nature of the Mo deficiency.

See also Co-operative Experiments page.

(D) TRACE ELEMENTS AND LIMING

Large responses to liming on this soil had been recorded during the previous four years. (See Table 9). In addition, in 1957, experiment (3) above had produced highly significant positive responses to Mn and to a mixture of B and Mo. The possibility exists that the effect of liming is in part due to the rendering available of a micro-nutrient. A test was laid out using peas.

(4) *Nitrogen, Phosphate and Potash*: The results were as anticipated. The indication of K deficiency at Goedgegun in Swaziland will be followed up in the field.

6B. TRACE ELEMENT FIELD EXPERIMENTS

(1) On Foothill Red Loams

STATION TRIALS

Four experiments with trace elements were laid out on the main substation at Machache.

(A) OBSERVATION TRIAL

Long plots of the following crops were traversed by "vertical" treatment strips: Potatoes, peas (two varieties), beans, cabbages, carrots and hairy vetch.

- Treatments*: (1) No trace elements applied.
 (2) Molybdenum trioxide at 4 oz. per acre.
 (3) Borax at 10 lb. per acre.
 (4) Manganese sulphate at 15 lb. per acre.

Results: Tests of significance could not be applied. Observations supported by the weights of produce showed no apparent effect from Mo and Mn while B depressed the yields of the legumes and carrots.

(B) TRACE ELEMENTS FOR BEANS

Treatments: See Table 17.

Arrangement: 2⁵ factorial design in 4 blocks. *Basal*: 300 lb. superphosphate per acre. *Variety*: Small white Haricot. *Application*: Salts mixed with basal, broadcast and disced in.

Results: See Table 17.

TABLE 17
Bean grain in 200-lb. bags per acre

<i>Treatment (weight per acre)</i>				<i>Mean Response</i>
Zn.	Zinc sulphate	...	15 lb.	-0.37
Mg.	Magnesium sulphate	...	50 lb.	+0.38
Mn	Manganese sulphate	...	15 lb.	-0.08
B	Borax	...	10 lb.	-0.28
Mo	Sodium molybdate	...	4 oz.	+0.08
Mean yield 4.3 S.E.				±0.23

Discussion: Neither main effect nor interactions were significant. During the early part of the season there was considerable erosion of the topsoil and movement of soil from one plot to another.

(C) TRACE ELEMENTS FOR MAIZE

The trial commenced in 1956 was continued, with treatments applied for a second time.

Treatments: Factorial combinations of the presence and absence of Cu, Zn, Mg, Mn and Mo where, per acre:—

Cu=15 lb. Copper sulphate.

Zn=15 lb. Zinc sulphate.

Mg=50 lb. Magnesium sulphate.

Mn=15 lb. Manganese sulphate.

Mo=4 oz. Molybdenum trioxide.

Arrangement: 2⁵ factorial design in 4 blocks. *Basal:* 200 lb. superphosphate plus 200 lb. nitramoncal plus 100 lb. muriate of potash per acre. *Variety:* S.A. 200 (maize).

Results: See Table 18.

TABLE 18
Maize grain in 200-lb. bags per acre

Factor	Mean Resp.	Response with									
		Cu		Zn		Mg		Mn		Mo	
		Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.
Cu	-0.32			0.26	-0.89	0.69	0.05	-1.02	0.39	-0.53	-0.10
Zn	-1.17	-0.59	-1.74	—	—	-0.85	-1.49	0.15	-2.49	-1.26	-1.08
Mg	0.43	0.07	0.80	0.76	0.11	—	—	0.47	0.40	0.14	0.73
Mn	+0.70	—	1.41	2.03	-0.62	0.74	0.67	—	—	1.93	-0.52
Mo	-1.03	0.81	1.24	0.93	1.12	0.73	1.32	2.25	0.20		—
S.E.	±0.77	S.E. ±1.09									

Discussion: While the mean responses to Mo and Mn are not statistically significant these elements have produced the largest positive effects. In 1957 both increased yields significantly.

The interactions Mo—Mn and Zn—Mn attain significance this year. Thus both Mo and Mn were effective only in the presence of the other of the pair and Mn in the presence of Zn.

Although the increments are small the fact that the crop was maize and not one more susceptible to micro-nutrient deficiencies adds interest to the results. Present Season experiments are designed to provide more information on the nature of the Mo deficiency.

See also Co-operative Experiments page.

(D) TRACE ELEMENTS AND LIMING

Large responses to liming on this soil had been recorded during the previous four years. (See Table 9). In addition, in 1957, experiment (3) above had produced highly significant positive responses to Mn and to a mixture of B and Mo. The possibility exists that the effect of liming is in part due to the rendering available of a micro-nutrient. A test was laid out using peas.

Treatments *Rates per acre*

O=No additions	...	...	...	...	—
L=Lime	...	...	...	...	3 tons
P=Superphosphate	...	...	...	...	300 lb.
B=Borax	...	...	...	...	10 lb.
Mo=Molybdenum trioxide	...	...	...	...	4 oz.
Mn=Manganese sulphate	...	...	...	...	15 lb.
ZnMg=Zinc sulphate	...	...	...	...	15 lb.
plus Magnesium sulphate	...	...	...	...	50 lb.
Mix=Mixture of B+Mo+Mn.					

Arrangement: Randomised blocks with split plots.

Applications: L and P ploughed in. Trace elements broadcast and harrowed in. *Variety:* Black Eye Susan.

Results: See Table 19.

TABLE 19
Dried peas in 200-lb. bags per acre

	<i>O</i>	<i>L</i>	<i>P</i>	<i>Mean</i>
O	1.73	1.82	2.30	1.95
B	1.51	1.84	2.50	1.95
ZnMg	1.69	1.67	2.63	2.0
Mix	1.58	1.53	2.32	1.81
Mn	1.82	1.75	2.12	1.90
Mo	1.42	2.18	2.12	1.91
Mean	1.63	1.80	2.33	1.92

S.E. ± 0.13

S.E. for horizontal comparisons ± 0.30 .

Discussion: The maturing crop was attacked by an unidentified green caterpillar which damaged the pods. Advanced plots suffered most. Like all the Machache experiments, soil erosion in the Spring may have affected the results. The only significant differences were those due to phosphate. The response to Mo in the presence of lime nearly attains significance.

(2) Trace Elements on a Red Sandy Loam

An exploratory trial was laid out on an area of typical red fine sandy loam (pH 5.4) on the Leribe experiment plot.

Treatments: Factorial combinations of the presence and absence of Cu, Zn, Mg, Mn, B and Mo where, per acre:—

Cu=10 lb. Copper sulphate.

Zn=15 lb. Zinc sulphate.

Mg=50 lb. Magnesium sulphate.

Mn=15 lb. Manganese sulphate.

B=10 lb. Borax.

Mo=4 oz. Molybdenum trioxide.

Arrangement: 2⁶ half replicate factorial design in 4 blocks of 8 plots each. *Basal:* 300 lb. Supers per acre. *Crop:* White Haricot beans. *Application:* Salts mixed with basal and drilled below seed at planting. *Plot Size:* 60' $\times$ 15'.

Results: See Table 20.

TABLE 20 (TRACE ELEMENTS ON A RED SANDY LOAM)

Dry beans in 200-lb. bags, per acre

Factor	Mean Response	Response with											
		Cu		Zn		Mg		Mn		B		Mo	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Cu	+0.98	—	—	1.01	0.95	1.30	0.65	0.84	1.11	0.76	1.20	1.19	0.76
Zn	-1.49	-1.46	-1.52	—	—	-1.82	1.16	1.26	-1.72	-2.05	-0.93	-2.29	-0.69
Mg	-0.58	-0.26	-0.91	-0.91	-0.26	—	—	0.31	-0.86	0.69	-0.48	0.36	-0.80
Mn	-0.21	-0.35	-0.07	-0.02	-0.45	0.06	-0.49	—	—	-0.48	1.06	-0.34	0.09
B	-0.79	-0.01	-0.57	-1.36	-0.23	-0.90	-0.69	-1.06	-0.53	—	—	0.99	-0.60
Mo	+1.25	1.46	1.03	2.05	0.45	1.45	1.03	1.12	1.37	1.05	1.44	—	—
S.E.	±0.46	—	—	—	—	±0.65	—	—	—	—	—	—	—

Mean yield 4.3.

Discussion: The confirmation of the molybdenum deficiency diagnosed in the greenhouse is most interesting, as is the depressing effect of zinc. The mean response of 250 lb. grain per acre represents a yield increase of 30%, achieved at a cost of 7/- per acre in this case, expensive "ANALAR" quality molybdenum trioxide being used. The response was 410 lb. grain per acre where no zinc had been applied. On this basis a nett increase in income, of £8 per acre is achieved for an extra outlay of 7/-.

(3) Trace Elements on Grey and Brown Sandy Loams

Two exploratory trials were planted, at Maseru and at Berea.

AT MASERU

Treatments and Design: As for (2) above. *Crop:* Black Eye Susan peas. *Application:* Salts mixed with basal superphosphate, broadcast and disced in (second successive application).

Results: See Table 21 A.

TABLE 21 A (TRACE ELEMENTS ON GREY-BROWN SANDY LOAM)
Dry peas in 200-lb. bags per acre

Factor	Mean response
Cu	+0.13
Zn	-0.42
Mg	+0.53
Mn	+0.41
B	+0.40
Mo	+0.24

Discussion: There were no significant differences in the poor crop, which was damaged by hail.

AT BEREA

Treatments: As for (2) above but omitting borax. Except for Mo the applications were the second in two years, no responses having been recorded in the previous maize crop. Mo was applied for the 1957/58 crop on plots which had previously received B.

Arrangement: 2⁵ factorial design in 4 blocks. *Crop:* Small white Haricot beans. *Plot Size:* 60' × 15'.

Results: See Table 21 B.

TABLE 21 B (TRACE ELEMENTS ON A GREY-BROWN SANDY LOAM)
Dry beans in 200-lb. bags per acre

Factor	Mean Resp.	Response with									
		Cu		Zn		Mg		Mn		Mo	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
Cu	+0.05	—	—	0.20	-0.11	0.13	-0.04	-0.44	0.53	0.31	-0.22
Zn	+0.19	0.34	0.04	—	—	-0.05	0.43	0.23	0.15	-0.60	0.98
Mg	+0.24	0.33	0.16	-0.46	0.94	—	—	0.73	-0.24	0.43	0.05
Mn	-0.08	-0.57	0.40	-0.42	-0.13	0.40	-0.57	—	—	0.01	-0.18
Mo	+1.61	1.88	1.34	0.82	2.40	1.80	1.42	1.70	1.52	—	—
S.E.	±0.42	S.E. ±0.60									

Mean yield 4.08

Discussion: As at Leribe (2) above, plots that had received Mo stood out clearly from the others. Plants were a dark green colour, taller and more vigorous. They spread out to cover the gaps between the rows in a solid tangled mass of vegetation. The effect was quite remarkable.

Both crops were heavily attacked by eelworm. The roots were so badly knotted that yields must have been significantly depressed by this pest. No difference in the incidence of knots could be detected between plots that had and had not received molybdenum, nor was there an apparent difference in nodulation, which was fair only. The eelworm knotting, however, made it difficult to obtain an accurate count of nodules.

Mo treatments on additional plots demonstrated clearly that the response was not due to residual boron.

The significant Zn-Mo interaction is of interest and should be further investigated.

A costing of the result gives a mean nett increase per acre of 322 lb. grain, worth £4 16s. 7d. and achieved at a cost of 7/-. This is at a producer's price for beans of £3 per bag (£4 is frequently obtained) and using the expensive, purest grade salt.

The result gave the third clear-cut field confirmation of molybdenum deficiency diagnosed in the greenhouse pot experiments.

(4) Co-operative Experiments with Trace Elements

Six small trials each with beans and maize were planted on Basuto farms on red loams in a 150-mile belt of the foothills.

Treatments: O=No trace element.

B=20 lb. borax per acre.

Mn=15 lb. Manganese sulphate per acre.

Mo=4 oz. sodium molybdate per acre.

Mix=Mixture of B+Mn+Mo.

Basal: 300 lb. superphosphate per acre. *Varieties:* A.N.F. maize and Black Eye Susan peas. *Application:* Salts mixed with basal and broadcast. *Arrangement:* 3 randomised blocks of 5 plots each.

Results: See Table 22.

TABLE 22

(YIELDS DERIVED FROM 6 MAIZE AND 4 PEA FARM EXPERIMENTS WITH TRACE ELEMENTS IN THE FOOTHILLS)

Dry grain in 200-lb. bags per acre

<i>Treatment</i>					<i>Maize</i> <i>Mean yield</i>	<i>Peas</i> <i>Mean yield</i>
O	...	...	...	...	5.27	1.13
B	...	...	...	...	5.50	1.18
Mix	...	...	...	...	5.71	1.24
Mn...	...	...	...	...	5.91	1.13
Mo...	...	...	...	...	5.94	1.32
Mean	...	...	...	...		
S.E.	...	...	...	...		
Variance ratio	...	...	...	...	Fraction	1.39
F. requirement	...	...	...	...	2.75	2.58
Coef. of variation	...	...	...	...	25.6%	20.1%



"Silver Eagle". Pure Arab stallion and foundation sire at Masaru Stud. Now 22 years old.



Recovery, four months after subsiding. Note necessity of fencing



Showing natural recovery in rippled areas—also note the masses of grass and weeds in cuts



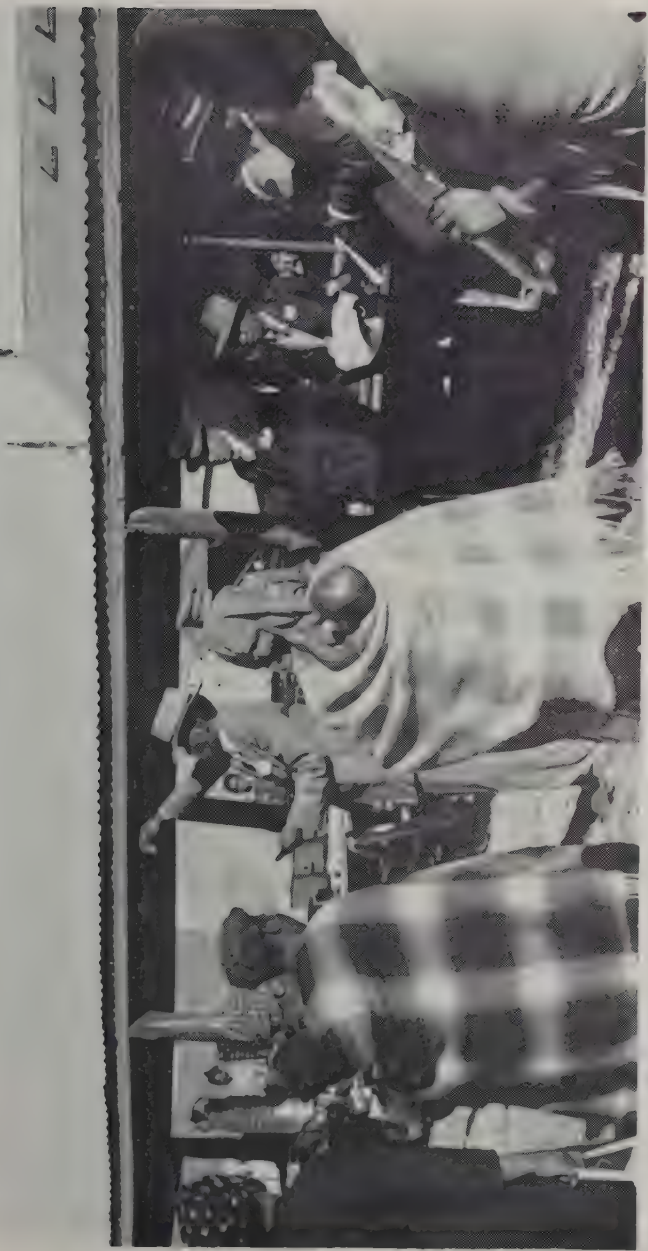
"So Valiant", progeny of "Silver Eagle" out of "Orange Valley Wilhemina" Pure Arab, 4 years



"Jupiter", progeny of "Silver Eagle", out of "Jasmine", three-quarter Arab. Now 3 years



Illustrating the extent of the soil conservation problem confronting the Department



Introducing the Chief of Rothe, Mascru, during the prizegiving ceremony — Mascru Central Show



Members of the first women's course held at the Agricultural School, Maseru, in January, 1959

Discussion: After the treatments were applied the farmer cropped his land in his usual manner. The technique proved too imprecise and the variation co-efficients for individual trials were high. The figures in Table 22 are from a series analysis of six experiments in the case of the maize and four for peas. It is seen that even on this basis no statistical significance can be attached to yield differences. Again, however, the highest yields are recorded on plots that had received Mo.

PASTURE PLOTS

Observation plots established by the principal of the agricultural school at Maseru were recently split for Mo—no Mo treatments. The effect of Mo on the growth of three varieties of clover was remarkable. Where Mo was applied (4 oz. trioxide per acre) plants were nearly double the size of those grown purely with heavy basal fertilizers. All half plots had been limed.

7. LOCAL MANURES

(1) Manure, Manure Ash and Fertilizers

The ash from manure burned in domestic fires accumulates in large heaps outside most village huts. Analysis shows it to be a valuable fertilizing material, containing approximately 2% P_2O_5 and 3% K_2O . Its direct and residual effect were compared with those of manure and fertilizer. In one trial beans measured second year residuals while in another maize tested direct effects.

Treatments:

O=No treatment.

D=Kraal manure (1.92% P_2O_5).

A=Manure/Ash.

P=1:1 mixture of raw Moroccan rock and superphosphate.

1=At rate to give 25 lb. P_2O_5 per acre.

2=At rate to give 50 lb. P_2O_5 per acre.

3=At rate to give 75 lb. P_2O_5 per acre.

Trial 1—Arrangement: 5 randomised blocks of 15 plots each.

Soil: Worked-out red sandy loam. *Variety:* Small white Haricot.

Trial 2—Arrangement: 6 randomised blocks of 10 plots each.

Soil: Grey-brown sandy loam. *Variety:* A.W.F.

Results: See Table 23.

Discussion: Yield differences are not statistically significant.

(2) Manure and Fertilizers

The long-term fertility trial at Maseru was continued. In a three-course rotation on three sites maize measures direct effects, beans test first year residuals while in wheat second year residual manure, phosphate and potash and direct nitrogen and phosphate are compared. In the subsequent maize crop, therefore, there is a comparison of the direct and first year residual effects of phosphate fertilizer.

Treatments: Factorial combinations of the presence and absence of N, P, K, D and P, where:—

Applied to maize only:

N=40 lb. N per acre as "Nitramoncal".

P=50 lb. P_2O_5 per acre as 1:1 mixture.

K=30 lb. K_2O per acre as muriate of potash.

D=50 lb. P_2O_5 per acre as kraal manure.

Applied to wheat only:

N=40 lb. N per acre as "Nitramoncal".

P=50 lb. P_2O_5 per acre as 1:1 mixture.

TABLE 23
Grain in 200-lb. bags per acre

Beans (2nd year residual)		Maize (directly manured)	
Treatment	Mean yield	Treatment	Mean yield
P3	5.45	D3	8.31
A2	4.73	D2	7.78
D2	4.57	A3	7.31
P1	4.52	D1	6.97
A3	4.34	A2	6.83
P2	4.21	P2	6.81
D1	4.01	A1	6.50
O	3.83	P1	5.80
A1	3.81	O	5.71
D3	3.74	P3	5.47
Mean ...	4.32		6.75
S.E. ...	—		—
Var. ratio ...	2.12		2.67
F. requirement	2.15		2.84

Arrangement: Two replicate 2^5 factorial designs repeated on three sites, each site in any one year carrying one phase of a rotation of maize, beans, wheat. *Soil:* Grey-brown sandy loam. *Varieties:* Maize, A.W.F.; Wheat, White Spitzkop; Beans, Small white Haricot.

Results: See Tables 24, 25 and 26.

TABLE 24 (DIRECT N, P, K AND D; FIRST RESIDUAL P')
Maize grain in 200-lb. bags per acre

Factor Mean Resp.		Response with									
		N		P		K		D		P'	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
N	3.67	—	—	3.22	4.13	2.95	4.39	4.28	3.06	3.00	4.34
P	-1.01	-1.46	-0.55	—	—	-1.52	-0.49	-0.42	-1.59	-1.15	-0.87
K	-0.05	-0.77	+0.67	-0.56	0.47	—	—	-0.16	-0.49	-0.49	-0.40
D	+0.58	+1.19	-0.03	1.17	0	0.47	0.70	—	—	1.48	-0.32
P'	-0.40	-1.07	+0.27	-0.54	-0.26	-0.85	0.04	0.50	-1.30	—	—
S.E.	±0.30	±0.42									

Mean yield=9.94. Coefficient of variation=12.0%.

TABLE 25 (FIRST RESIDUAL N, P, K AND D, 2ND RESIDUAL P')
Bean grain in 200-lb. bags per acre

Factor	Mean Resp.	Response with									
		N		P		K		D		P'	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
N	0.27	—	—	0.41	0.13	0.19	0.36	0.25	0.30	0.44	0.11
P	-0.40*	-0.26	-0.54	—	—	-0.88*	0.08	-0.46	-0.34	-0.56*	-0.25
K	-0.17	-0.26	-0.08	0.65*	0.31	—	—	-0.23	-0.11	-0.07	-0.26
D	-0.33	-0.36	-0.31	-0.39	-0.27	-0.39	-0.28	—	—	-0.46	-0.21
P'	0.05	0.21	-0.11	-0.11	0.21	0.14	-0.05	-0.07	0.17	—	—
S.E.	±0.19	±0.26									

Mean yield=3.06. Coefficient of variation=24.53%.

TABLE 26 (2ND YEAR RESIDUAL P, K AND D, DIRECT N AND P')
Wheat grain in 200-lb. bags per acre

Factor	Mean Resp.	Response with									
		N		P		K		D		P'	
		Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.	Abs.	Pres.
N	1.319	—	—	0.692	1.946	1.604	1.034	1.363	1.276	-0.220	2.859
P	0.857	0.230	1.485	—	—	0.811	0.904	0.725	0.990	2.528	-0.813
K	0.972	0.382	0.188	0.050	0.144	—	—	0.289	-0.094	0.191	0.004
D	0.559	0.012	0.099	0.077	0.089	0.247	0.136	—	—	0.025	0.087
P	2.739	1.200	4.278	4.409	1.069	2.833	2.646	2.708	2.770	—	—
S.E.	±0.264	±0.373									

Mean yield=4.58. Coefficient of variation=22%.

Discussion: The results are unusual and demonstrate the need for caution in assessing those from trials testing N and P in relation to plant populations (Table 3). The figures in Table 24 are from a population of 7,400 plants per acre.

Treatment effects in the maize and beans are, undoubtedly, related to the fact that the experiment sites lay waterlogged for much of the season. In the case of the wheat the aphid damage referred to earlier affected yields.

(3) Rotations and Manures

In a second long-term experiment at Maseru four crop rotations and two systems of manuring and fertilizing are compared. Amongst others the trial will test the possibility, suggested by Dr. Herbert Greene, that greater fertilizer efficiency and economy may be achieved by increasing phosphate applications for legumes and making use of residual P effects in subsequent cereal crops in the rotation, which are fertilized with nitrogenous fertilizers.

The results to date are incomplete and are not presented.

8. TILLAGE EXPERIMENTS

Two experiments comparing various methods of initial tillage of the soil, including very deep ploughing, were planted at Maseru.

No significant differences were recorded in maize testing the residual effects of tillage operation carried out before the previous maize crop. In the first crop deep ploughing with the addition of 300 lb. gypsum per acre had significantly increased yields. The soil was a typical grey-brown solodised solonetz. In the report for 1957 it was pointed out that the additions of the sulphate might have been the operative factor in producing the response.

The second experiment failed. In its early stages, however, it was noticeable that plots which had been ploughed deeply and to which gypsum had been added were outstandingly better than those which had not received gypsum. The soil was similar to that of the first trial.

9. WINTER GRAZING OF ARABLE LAND

All lands in Basutoland that have been cropped in Summer are heavily grazed in winter on a communal basis. Usually the remnant stalks and dropped dung are removed after the grazing for use as fuel. A minimum of organic matter is thus returned to the soil and the practice must have an important adverse effect on soil fertility. The experiment commenced in 1955 was continued:—

Treatments: See Table 27. *Arrangement:* Randomised blocks (4).

Results: See Table 27:

TABLE 27 (WINTER LAND USE)
Maize grain in 200-lb. bags per acre

1. No grazing after harvest	...	...	...	8.81
2. 1,500 large stock grazing hours per acre	...	...	...	9.08
3. As for 2, plus remnant stover removed	...	...	...	8.64
4. As for 2, plus dropped dung removed	...	...	...	8.77
5. As for 2, plus stover and dung removed	...	...	...	8.86
Mean				8.83
Variance ratio				Fraction
Coef. of var.				6.2%

Discussion: There were no significant differences. Effects will, no doubt, only appear after many years.

10. THE ECONOMICS OF FERTILIZING WITH PHOSPHATES

The scheme of establishing simple experiments with phosphate fertilizers on farmers' holdings in all lowland districts was continued. After an experiment is pegged out and the fertilizer applied and ploughed in, the farmer plants and tends the crop in his usual manner. Thirty-two experiments were laid out.

Treatments: Four rates of the 1:1 mixture of superphosphate and raw Moroccan rock phosphate, where:—

P0=No fertilizer.

P1= 75 lb. per acre

P2=150 lb. per acre

P3=225 lb. per acre

} Containing $\pm 26\%$ P_2O_5 .

Arrangement: Randomised blocks (3). *Crops:* Maize (various varieties). *Soils:* Various.

Results: See Table 28.

Discussion: "Typical" lands that had not been manured were chosen for the experiments. However, as demonstrators had to work with co-operative farmers it is likely that the standard of farming on these trials was better than average. The mean yield for the season on plots that were not fertilized was, nevertheless, only 2.31 bags per acre. This is indicative of the standard of farming in Basutoland.

Responses to phosphate were slightly lower than in previous years, averages being 0.76, 0.91 and 1.31 bags per acre for 75, 150 and 225 pounds of fertilizer respectively. That each year the mean yields in this series for southern districts are better than those for the better watered northern districts is of interest. The phenomenon is reflected by the trend in soil pH.

11. CROP STUDIES

A limited programme of investigation into crop species and varieties in relation to the ecological zones of Basutoland was undertaken. Certain production and economic problems in the Territory are related not so much to soil fertility considerations as to ones of lack of environmentally suited varieties.

Thus the export of hard wheats to the Union, used there for blending purposes, once constituted a major source of revenue for the Territory. Exports are much smaller today and the (baking) quality of the crop has deteriorated to the extent that distributors find difficulty in disposing of it. Similarly the quantity and quality of pea exports have fallen.

Because of the lack of short season maize and sorghum varieties suitable for use in the mountains, large amounts of these foods have to be transported to the interior each year, at considerable cost. Lack of information on legume varieties handicapped the Agricultural Department in its extension work.

11 A. MOUNTAINS AND FOOTHILLS

(1) Wheat

In 1953 81 field samples were collected from lands in the mountains. These have been planted out each year for selection and comparison at Machache or Mokhotlong. During the last two years eight selections have been compared in replicated trials at Mokhotlong.

Because staff, equipment and produce are flown into and out of Mokhotlong, micro-plot or sampling techniques are used for wheat investigations at this remote station.

TABLE 28. (CO-OPERATIVE PHOSPHATE EXPERIMENTS, 1957/58)
Maize grain in 200-lb. bags, per acre
NORTHERN DISTRICTS

District	Butha-Butha			Leribe			Berea			Pilot Project			Means
	Liqhakoeng	Liqhakoeng	Tsime	Qalo	Hlotse	Hlotse	Pitseng	Pitseng	Berea	Berea	Lithabamneng	Mesagela	
Soil pH	...	...	...	...	...	...	...	...	...	...	...	...	...
Treatments:	P0	P1	P2	P3	...	...	...	...	...	...	...	...	...
(Mean Yields)	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean...	...	...	...	...	...	...	...	...	...	...	...	...	...
S.E. mean yields	...	...	...	...	...	...	...	...	...	...	...	...	...
L.S.D. (5%)	...	...	...	...	...	...	...	...	...	...	...	...	...

P0=No fertilizer.

P1= 75 lb. per acre

P2=150 lb. per acre

P3=225 lb. per acre

} Containing $\pm 26\%$ P_2O_5 .

Arrangement: Randomised blocks (3). *Crops:* Maize (various varieties). *Soils:* Various.

Results: See Table 28.

Discussion: "Typical" lands that had not been manured were chosen for the experiments. However, as demonstrators had to work with co-operative farmers it is likely that the standard of farming on these trials was better than average. The mean yield for the season on plots that were not fertilized was, nevertheless, only 2.31 bags per acre. This is indicative of the standard of farming in Basutoland.

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District	Butha-Buthe				Lerihe				Berea				Pilot Project			Means
	Liqhakoeng	Liqhakoeng	Tsime	Qalo	Hlotse	Hlotse	Pitseng	Pitseng	Berea	Failure	Berea	Lithabang	Mesagela	Thaba-Chitja	Failure	
Soil pH	5.8	5.3	6.0	5.6	6.0	6.0	6.0	5.4	6.0	5.6		6.2	6.0	5.5	5.4	
Treatments:	3.59	2.38	3.55	5.40	1.53	2.38	1.29	0.22	1.45	2.02	0.65	0.61	1.21	2.10	Failure	2.03
P0	4.11	2.95	4.11	6.94	3.15	2.78	1.61	0.97	2.02		1.53	0.97	1.61	2.50		2.71
P1	4.44	3.95	4.19	6.61	2.98	4.52	1.94	0.73	2.26		1.53	1.65	2.10	3.15		3.01
P2	4.84	4.64	5.08	8.03	3.51	3.23	1.94	1.53	2.98		1.98	2.14	2.02	3.03		3.46
P3																
(Mean Yields)																
Mean...	4.24	3.48	4.24	6.75	2.79	3.23	1.69	0.86			1.30	1.34	1.74	2.69		2.64
S.E. mean yields	0.13	0.18	0.27	0.40	0.37	0.78	0.32	0.38	0.11		0.11	0.10	0.21	0.23		
L.S.D. (5%)	0.47	0.63	0.93	1.38	1.28				0.37		0.40	0.35				

SOUTHERN DISTRICTS

District	Maseru				Mafeteng			Mohale's Hoek				Quthing				Means	
Area				Morija		Magotiu	Qabas	Qabas	Ramathes	Monyake	Maphut-seng	Maphut-seng	Moyeni	Moyeni	Mt. Moorosi	Mt. Moorosi	
Soil pH	...	...	...	5.6		6.0	5.4	5.5	6.2	6.1	6.2	6.3	6.2	6.6	6.4	6.3	
Treatments:	P0			0.77	Failure	3.95	8.47	0.89	5.57	2.26	2.34	1.13	0.89	1.77	2.10	0.97	2.59
	P1			1.01	Failure	3.63	10.65	1.74	6.21	3.31	4.28	3.39	1.13	1.69	2.82	1.29	3.43
(Mean Yields)	...P2			1.49	Failure	5.08	8.95	1.98	6.05	2.66	4.84	3.55	0.32	1.86	3.07	1.29	3.43
	P3			1.25	Failure	4.76	9.80	2.06	7.58	3.07	5.16	3.79	0.81	2.26	3.47	1.21	3.77
Mean...	...			1.13		4.36	8.16	1.66	6.35	2.82	4.16	2.96	0.79	1.89	2.86	1.19	3.19
S.E. mean yields $\pm$	...			0.12		0.50	0.23	0.05	0.40	0.46	0.84	1.18	0.19	0.29	0.75	0.23	
L.S.D. (5%)	...			0.40				0.18									

Circumstances have not allowed of the detailed recording of growth data and, apart from notes on stem and leaf rust resistance, yields have been the main criteria for selection.

Arrangement: 1 randomised blocks (b). *Seeding:* 100 lb. per acre.

Results: See Table 29.

TABLE 29 (MOUNTAIN WHEAT)
Wheat grain in 200-lb. bags per acre

Variety	Mean yield	
	1957	1958
WM 14	10.15	10.26
MM 54	9.74	9.80
E.K. 70	10.04	9.75
L.P. 79	9.14	9.74
W.M. 68	7.72	9.36
J.N. 41	7.72	9.25
W.M. 18	10.12	9.06
E.R. 5	10.47	8.34
Mean	10.10	9.44
S.E. mean yields $\pm$	—	0.01
Var. ratio	0.85	1.67
F. reqmt.	20.60	2.28
Coef. of var.	2.28 2%	1.10%

Discussion: Yields were high but varietal differences are not statistically significant.

(2) Maize

Eight varieties were compared at Mokhotlong.

Arrangement: Randomised blocks (5); Spacing, 3' $\times$ 18".

Results: See Table 30.

TABLE 30 (MOUNTAIN MAIZE)
Maize grain in 200-lb. bags per acre

Variety	Mean yield
S.A. 200	14.71
Cincinnati	12.47
Eksteen	11.92
Wisconsin	11.37
Natal 8-row	11.14
White Bushman	11.14
Yellow Bushman	10.17
Bread Maize	9.44
Mean	11.54
S.E. mean yields	0.59
L.S.D. (5%)	1.74
Var. ratio	7.26
F. Reqmt.	2.49
Coef. of var.	10.2%

SOUTHERN DISTRICTS

District	Maseru			Mafeteng				Mohale's Hoek				Quthing			Means
Area															
Soil pH	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Treatments:	P0	...	...	...	...	...	...	...	...	...	...	...	...	...	...
(Mean Yields)	P1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...P2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	P3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
S.E. mean yields $\pm$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
L.S.D. (5%)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Circumstances have not allowed of the detailed recording of growth data and, apart from notes on stem and leaf rust resistance, yields have been the main criteria for selection.

Arrangement: 1 randomised blocks (b). *Seeding:* 100 lb. per acre.

Results: See Table 29.

TABLE 29 (MOUNTAIN WHEAT)
Wheat grain in 200-lb. bags per acre

Variety	Mean yield	
	1957	1958
WM 14	10.15	10.26
MM 54	9.74	9.80
E.K. 70	10.04	9.75
L.P. 79	9.14	9.74
W.M. 68	7.72	9.36
J.N. 41	7.72	9.25
W.M. 18	10.12	9.06
E.R. 5	10.47	8.34
Mean	10.10	9.44
S.E. mean yields $\pm$	—	0.01
Var. ratio	0.85	1.67
F. reqmt....	20.60	2.28
Coef. of var.	2.28	1.10%
	2%	

Discussion: Yields were high but varietal differences are not statistically significant.

(2) Maize

Eight varieties were compared at Mokhotlong.

Arrangement: Randomised blocks (5); Spacing, 3' x 18".

Results: See Table 30.

TABLE 30 (MOUNTAIN MAIZE)
Maize grain in 200-lb. bags per acre

Variety	Mean yield
S.A. 200	14.71
Cincinatti	12.47
Eksteen	11.92
Wisconsin	11.37
Natal 8-row	11.14
White Bushman... ..	11.14
Yellow Bushman	10.17
Bread Maize	9.44
Mean	11.54
S.E. mean yields	0.59
L.S.D. (5%)	1.74
Var. ratio	7.26
F. Reqmt.	2.49
Coef. of var.	10.2%

Discussion: The performance of the South African double hybrid S.A. 200 is outstanding. In spite of the dangers inherent in the use of hybrids in peasant agriculture (use of segregated seed) attention should be paid to the possibility of importing S.A. 200 for use in the mountains. At Machache, in the trace element and lime trials, this hybrid on several plots gave yields in excess of 30 bags per acre!

(3) Peas

Two varieties, known to the trade as "Basuto Yellow" and "Basuto Green", are commonly grown in the mountains. Increasing amounts of the "Green" are being grown at the expense of the "Yellow". There is little demand for the former in its dried export form and it fetches considerably lower prices.

Nine South African varieties were compared with the two local types at Mokhotlong.

Arrangement: Randomised blocks. *Spacing:* 3' × 9".

Results: Basuto Yellow and Basuto Green, both of which took three weeks longer to mature than the slowest growing imported variety, significantly outyielded all others. See Table 31.

TABLE 31 (MOUNTAIN PEAS)
Dried peas in 200-lb. bags per acre

<i>Variety</i>	<i>Mean yield</i>
Basuto Yellow	13.87
Basuto Green	11.29
Tuinbou Sel. 20-2	6.66*
Black Eye Susan	6.21
Wando	5.89
Tuinbou Sel. 20-1	5.24
Stratagem	5.08
Orange Kroon	4.92
Stomppeul	4.52
Onward	3.63
Greenfeast	3.23
Mean	6.39
S.E. mean yields	0.63
L.S.D. (5%)	1.78
Var. ratio	29.90
F. reqmt....	2.15

*=From extra plots, not to be included in statistical comparison.

(4) Sorghum

In 1935 360 samples of early maturing sorghum were collected in the foothills. By annual selection these have been reduced to eight lines, which were to have been compared in a replicated trial at Machache. Spring floods so damaged the trial that it was abandoned.

(5) Other Crops

As usual observation plots of a large range of crops and varieties, including 61 wheat varieties and 16 beans, were planted at Mokhotlong. In due course replication in time will allow of the extraction of useful results.

11 B. LOWLANDS

All work on crops for the lowlands has been based on South African varieties, climatic and soil conditions on either side of the lowland border being so similar.

(1) Maize

At Maseru 16 varieties were compared for early planting and seven for late planting. The former trial failed because of a technical error. The results for late planting follow:—

Arrangement: Randomised blocks (b). *Spacing:* 3' × 12".

Basal: 200 lb. supers plus 100 lb. Nitramoncal per acre.

Planted: 1/12/57. *Harvested:* 1/6/58.

Results: See Table 32.

TABLE 32 (LOWLAND MAIZE)
Maize grain in 200-lb. bags per acre

Variety	Mean yield
S.A. 200	13.26
Natal 8-row	9.14
Wisconsin	9.01
Eksteen	8.99
Cincinatti	8.29
White Bushman... ..	7.95
Yellow Bushman	7.89
Mean	9.22
S.E. mean yields	±0.56
L.S.D. (5%)	1.62
Var. ratio	10.88
F. reqmt.... ..	2.42

Discussion: As in previous years the hybrid S.A. 200 outyielded all others. Natal 8-row, a suckering type, was favoured by the wet season.

(2) Summer Wheat

Thirty-six selections supplied by the Bethlehem Agricultural Research Station in the Union were compared in a micro-plot replicated trial. The results have been returned to Bethlehem and are not presented.

(3) Winter Wheat

The annual trials of 25 commercially available varieties were continued at Maseru.

Arrangement: 5 × 5 lattices with 4 replications. *Seeding:* 40 lb. per acre, broadcast. *Basal:* 200 lb. supers plus 100 lb. Nitramoncal per acre. *Early Planted:* Planted 15/4/57. *Late Planted:* Planted 1/6/58.

Results: See Tables 33 and 34.

TABLE 33

Early planted wheat winter in 200-lb. bags per acre

Variety	Rank on 4 rankings	Rank on ave. yield	Ave. yield 4 years	1954		1955		1956		1957	
				Rank	Mean yield	Rank	Mean yield	Rank	Mean yield	Rank	Mean yield
Scheepers	1	3	3.63	5	3.32	3	4.55	2	3.60	12	3.06
Lowland	2	2	3.86	10	3.00	4	4.48	5	3.26	3	4.70
Red Spitzkop	3	5	3.52	3	3.72	9	3.81	3	3.39	11	3.17
Red Egyptian	4	4	3.53	7	3.20	2	4.55	10	2.82	7	3.53
Red Victory	5	1	3.03	25	1.78	5	4.18	1	3.73	1	6.41
White Spitzkop	6	7	3.44	1	3.84	15	3.55	8	2.97	8	3.39
Maluti	7	8	3.24	9	3.17	6	4.11	7	3.03	15	2.66
Punjab	8	11	3.14	2	3.79	12	3.67	6	3.06	22	2.05
Penkop	9	14	3.09	6	3.26	11	3.73	9	2.84	17	2.51
Sterling	10	12	3.13	12	2.91	8	3.84	16	2.48	9	3.29
Harpers	11	13	3.10	16	2.82	7	3.91	11	2.81	14	2.86
Mountain 2	12	6	3.51	21	2.36	13	3.64	12	2.81	2	5.23
Queen Fan	13	9	3.20	17	2.65	1	4.82	25	1.14	5	4.17
Roussouws B	14	16	3.02	8	3.18	17	3.53	4	3.32	21	2.05
Talberg	15	10	3.16	22	2.34	14	3.63	13	2.74	6	3.91
Impala	16	18	2.98	15	2.86	10	3.75	17	2.46	13	2.86
Mountain 1	17	15	3.09	24	1.98	18	3.52	14	2.69	4	4.18
Goudveld	18	19	2.90	4	3.37	19	3.45	19	2.36	19	2.41
Hoopvol	19	17	2.99	14	2.89	20	3.42	18	2.43	10	3.21
Daeraad	20	20	2.67	11	2.94	16	3.55	20	2.31	24	1.89
Vorentoe	21	21	2.56	18	2.59	23	2.86	15	2.61	20	2.17
Sonop	22	22	2.50	13	2.89	21	3.34	23	1.92	25	1.84
Duiker	23	25	2.35	23	2.09	22	2.95	22	1.92	18	2.44
"Manitoba"	24	23	2.39	20	2.40	25	2.74	24	1.85	16	2.57
Lalkasarwali	25	24	2.37	19	2.43	24	2.81	21	2.27	23	1.98
Mean			3.10		2.87		3.70		2.67		3.14
S.E. mean ylds.					±0.16		±0.07		±0.08		±0.37

Discussion: Winter Wheat production is based on the utilisation of moisture conserved in the soil during the autumn months. However, Basuto peasant farmers do not own implements such as disc harrows suitable for the constant superficial tilling of wheat lands and for this reason planting cannot usually be extended beyond May. The measure of insurance against Spring droughts which is afforded by late planting is, therefore, lost to them. The results from the lowland early planted experiments are more applicable to present-day land conditions. The Spitzkop varieties, Red Victory and Scheepers can safely be recommended to farmers.

(4) Beans

Sixteen varieties were compared at Maseru. The experiment has the weakness of not including times of planting as factors and the quick maturing types are disadvantageously placed.

TABLE 34

Late planted winter wheat in 200-lb. bags per acre

Variety	Rank on 4 rankings	Rank on ave. yield	Ave. yield 4 years	1954		1955		1956		1957	
				Rank	Mean yield	Rank	Mean yield	Rank	Mean yield	Rank	Mean yield
Red Victory	9	1	3.91	25	1.29	1	5.85	1	5.28	17	3.22
Red Spitzkop	2	2	3.72	4	2.25	12	4.65	7	3.81	5	4.16
White Spitzkop	3	3	3.72	1	2.47	13	4.65	11	3.52	4	4.25
Queen Fan	11	4	3.68	23	1.52	5	5.22	2	4.80	18	3.17
Maluti	1	5	3.68	3	2.41	6	5.03	9	3.66	9	3.63
Goudveld	10	6	3.68	13	1.82	19	4.34	12	3.45	1	4.86
Lowland 1	5	7	3.62	9	1.90	4	5.47	6	4.25	21	2.87
Talberg	7	8	3.60	6	2.10	18	4.34	3	4.63	16	3.31
Mountain 2	13	9	3.60	22	1.55	14	4.55	5	4.55	8	3.76
Mountain 1	4	10	3.58	5	2.16	7	4.85	4	4.55	22	2.76
Punjab	8	11	3.48	7	2.07	3	5.48	14	3.31	19	3.04
Penkop	14	12	3.40	20	1.61	10	4.76	10	3.64	10	3.57
Red Egypton	6	13	3.31	2	2.45	2	5.49	13	3.37	25	1.93
Impala	16	14	3.31	10	1.83	17	4.38	22	2.43	2	4.60
Roussouws B	15	15	3.30	15	1.81	8	4.82	16	3.15	11	3.42
Scheepers	17	16	3.25	12	1.82	16	4.41	8	3.79	20	2.96
Harpers	18	17	3.22	17	1.76	11	4.74	18	2.97	12	3.41
Sterling	20	18	3.12	16	1.78	20	4.18	21	2.45	6	4.08
Daeraad	12	19	3.08	11	1.83	9	4.80	25	1.25	3	4.36
Lalkasarwali	19	20	3.06	8	1.94	23	3.63	15	2.38	14	3.37
"Manitoba"	21	21	3.06	24	1.42	22	3.74	17	3.06	7	4.00
Vorentoe	22	22	2.89	14	1.82	15	4.52	19	2.82	23	2.38
Sonop	23	23	2.82	18	1.74	24	3.57	20	2.58	13	3.40
Duiker	24	24	2.57	19	1.72	25	3.06	23	2.13	15	3.36
Hoopvol	25	25	2.41	21	1.56	21	4.10	24	1.69	24	2.36
Mean			3.31		1.90		4.55		3.37		3.43
S.E. mean ylds.					±0.17		±0.05		±0.17		±0.74

Arrangement: 4×4 lattices with 4 replicates. Basal: 200 lb. supers per acre. Spacing: $3' \times 6''$. Planted: 2/12/57.

Results: See Table 35.

Discussion: Yields were good. At least one more set of results are required before varieties can be recommended.

(5) Cowpeas

Sixteen varieties of grain and forage types were compared for grain yield, including several lines supplied by the Potchefstroom Research Station.

Arrangement: 4×4 simple lattice, 4 replicates.

Basal: 200 superphosphate per acre.

Results: See Table 36.

Discussion: This was the first trial with cowpeas at Maseru. Testing continues.

TABLE 35
Dry beans in 200-lb. bags per acre

<i>Variety</i>	<i>Mean yield</i>
Michigan Pea	9.39
Khaki Sugar	8.55
White Haricot	8.48
Van Zyl Sugar	7.78
Khaki Speckled	7.67
Tepary	7.57
Canary Yellow	7.54
Bombust	7.39
Natal Yellow	7.06
Ginger Speckled	7.04
Black Zebra	7.00
Canadian Wonder	6.95
Pink Wachter	6.78
Long Tom	6.53
Red Sugar	6.50
Purple Speckled... ..	5.41
Mean	7.35
S.E. mean yields	0.66
L.S.D. (5%)	1.86
Coef. of var.	17.90
Var. ratio	2.10
F. reqmt.... ..	1.92

TABLE 36
Cowpea grain in 200-lb. bags per acre

<i>Variety</i>	<i>Mean yield</i>
Dr. Saunders	6.55
New Era	6.08
Local	5.91
Witsenberg	5.58
White Wonder	4.32
Iron Grey	4.32
51. C. 299	4.20
53. C. 29	4.15
51. C. 57	4.12
Unknown	4.04
51. C. 295	3.61
51. C. 277	3.53
51. C. 267	3.50
51. C. 295	3.22
51. C. 42	1.82
51. C. 421	1.01
Mean	4.12
S.E. mean yields	0.42
L.S.D. (5%)	1.19
Coef. of var.	20.50
Var. ratio	11.91
F. reqmt.... ..	1.92

2. SUMMARY AND CONCLUSIONS

The black clays in the mountains are extremely fertile. The improvement of production in this region will depend mainly on the use of suitable varieties and on weed control. The summary below deals with the foothills and lowlands.

Nitrogen: Nitrogenous fertilizers have been shown to increase maize yields in the lowlands in a normal season when applied to a stand of 15,000 plants per acre. Forty pounds N per acre side-dressed produces a highly economic response (where soil N has not been built up by manuring or other means). It appears that when Spring rainfall is excessive either planting density should be reduced or more fertilizer nitrogen applied. Nitrogenous fertilizers have no effect on the heavier foothill loams.

Results from the nitrogen manuring of winter wheat are inconsistent but largely negative. Sorghum does not respond to applied N.

Phosphate: All soils except certain alluvial deposits should, in the absence of manure or manure ash, be annually fertilized with phosphates. While initially superphosphate is best, basic slag and raw Moroccan rock prove superior after the third year of application on unlimed soils. Negative curvature responses indicate that somewhat less than 50 lb. P_2O_5 per acre is the optimum economic dressing.

Co-operative experiments have not only demonstrated the poor standard of farming in Basutoland but have shown that even without improved management the use of phosphatic fertilizers is economic.

The mean yields in bags per acre from 81 farm maize experiments over four seasons are as follows: No phosphate=2.71, 20 lb. P_2O_5 3.72, 40 lb. P_2O_5 =4.15, 60 lb. P_2O_5 =4.51. Those from 57 station results are: No phosphate 4.2, 50 lb. P_2O_5 =8.1. At a producer's price for maize of 25/- per bag and the 1:1 fertilizer at £15 per ton the results from the co-operative experiments show the following average nett profits per acre from fertilizing with 70, 150 and 225 lb. of phosphate mixture: 70 lb.=11/8, 150 lb.=13/8, 225 lb.=11/3. On the same basis the station results show a mean nett profit from 200 lb. phosphate mixture per acre of £3 7s. 6d. The latter must give a good estimate of potential on the poorer soils. The results from the co-operative trials are for the first year of application of a broadcast fertilizer. Responses in second and succeeding years, with annual applications, would be larger.

Manuring: The beneficial effects of manure and manure ash have been demonstrated and measured. The mean response in maize to manure containing 50 lb. P_2O_5 per acre is 2.8 bags per acre. The residual effect of this dressing does not persist into the third season.

The maintenance of soil fertility in Basutoland cannot be based to any great extent on the use of manure and ash, and fertilizers must play a greater role. The annual potential requirement is assessed at

30,000 tons of 20% phosphate and 10,000 tons of 20% of nitrogen fertilizer. Increased use of legumes with trace element nutrition and larger local fuel supplies may reduce these.

Potash: The soils of Basutoland are not deficient in potash and cereals and legumes do not respond to added K. (136 results).

Lime: The sandy loams of the lowlands benefit from liming at the rate of one ton per acre. The use of larger amounts on the weakly buffered light grey-brown and brown soils is dangerous and iron deficiency induced by liming at $1\frac{1}{2}$ tons per acre has been shown to persist five years after lime is applied.

The foothill red loams require lime and dressings of three tons per acre and have produced considerable yield increases in maize and wheat. Mean maize yields from four seasons in bags per acre as follows:—

	L0	L2	
			P2=50 lb. P_2O_5 per acre.
PO	5.51	8.46	L2=3 tons lime per acre.
P2	8.63	12.50	

This effect of lime may be related to micro-nutrient availability.

Trace Elements:

(a) *Sulphur.* It is doubtful whether the general sulphur deficiency indicated by pot experiments does exist in the field. There is evidence from early trials with sulphate of ammonia that this is not the case. Further research is required.

(b) *Zinc.* Results on a possible zinc deficiency are limited and inconclusive.

(c) *Manganese.* A deficiency of available Mn on a foothill red loam site has been confirmed (1957) but no further information has been gathered on the extent of the deficiency.

(d) *Molybdenum.* (1) There is definite proof that certain areas representative of the main soil types are Mo deficient and that the additions of small amounts of molybdenum trioxide increases the yields of certain crops. Molybdenum deficiency diagnosed in the greenhouse on four soil types has so far been confirmed in the field. The subtractive pot experiment technique is shown to be a valuable tool for soil deficiency diagnostic work.

(2) There is further evidence that the Mo deficiency is widespread in the lowlands and foothills.

(3) Taking into account the geographical distribution and varied nature of the soils (and parent materials) on which either proof or evidence of molybdenum deficiency is available, together with certain other factors and scraps of information, the writers suggest that the deficiency may extend over a large area of southern Africa.

The results, though preliminary and meagre, warrant a specialised programme of investigation both in Basutoland and adjoining areas of the Union. Is moisture, after all, the factor precluding the establishment of good non-irrigated clover-grass pastures on the southern

African plateau? Will the lack of attention to soil nutrition, and trace elements in particular, prove to vitiate results from masses of work on pasture species, as was the case at a centre in Kenya?

Crops: Although much information has been collected more results are required before sound recommendations can be made on crop varieties in relation to ecological regions.

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The statistical analyses for this report were carried out by Mr. C. M. Morojele, recently appointed statistician to the Agricultural Department. Thanks are also due to Mr. C. M. K. Seape for his assistance with the experiments at Mokhotlong.

The excellent work of Messrs. E. M. Matsela, S. M. Moliboea, M. B. Masia and S. Kabi, the Agricultural Demonstrators seconded as Experiment Recorders, must be placed on record.

A. C. VENN,

Soil Fertility Worker, Basutoland (now Swaziland).

A. C. MACINTOSH,

Agricultural Research Officer.

2. MECHANISED GROUP FARMING

During the year it was decided to apply for the closure of this scheme as it was felt that most of the information available had been obtained and that to continue would involve the scheme in unnecessary expenditure.

Formal approval for this action has not yet been granted but it is hoped it will be forthcoming.

A full report on the scheme will be submitted at its closure.

3. PILOT PROJECT

Location: Catchment of Tebetebeng River in the Berea district, Basutoland. (Centre of area approximately 29° 12' South, 27° 53' East). Rainfall=28.91". Maximum temperature recorded was 31.0°C and minimum was -2.0°C

General Description and Objectives

The scheme is being carried out in the upper catchment of the Tebetebeng River—a valley approximately 20 miles long by three miles wide. The total area comprises some 63 square miles of lowland, foothill and a little mountain country, ranging from 5,000 ft. to 8,500 ft. At present, approximately 20,200 acres are being cultivated, 13,000 acres are being used for grazing only, 600 acres are reed bed and 7,500 acres are exposed sandstone. These figures are drawn from the preliminary results of a recent soil conservation land analysis survey.

The total population is 12,000 (3,000 of whom are absent in the Union). These figures were obtained at the time of the 1956 Territorial population census. There are some 30 chiefs and headmen who have areas in the valley, but all are subordinate to the Ward Chief of 'Mamathe's. This ward, which includes the Pilot Project area, is part of Berea district.

The aim of the scheme is to carry out a combination of:—

(1) *Reclamation* of arable and grazing land which is being improperly used (i.e. soil conservation, grazing control and improved land use);

(2) *Demonstration* of tried and tested systems and practices, especially in regard to agriculture;

(3) *Investigation* of field methods which are new to Basuto people, but which can probably be adapted to local conditions;

(4) *Community development*, i.e. local self-help schemes to encourage the people to improve their living conditions. The principle underlying all Pilot Project activities is that the Government staff will work with, rather than for, the people. The active participation of the community, group or individual is sought in every undertaking.

A detailed plan for the work to be undertaken during the last two years of the life of the present scheme has been drawn up. This plan was put into operation with effect from the 1st April, 1958; its objectives are in conformity with the aims of the scheme. There is, however, greater emphasis on the educational aspects, so that the community living in the area should become more and more aware of the need to improve its living conditions, in the widest sense. In this way the Pilot Project will be a focal point for the introduction of new ideas and practices to the Basuto nation. The various schemes being tried within the area also aim to encourage the emergence of new local leaders of the community.

Progress to Date:—

A. RECLAMATION

(a) *Soil Conservation*

Although basic soil conservation measures have been applied throughout the valley, by way of mechanically-constructed bunds and buffer grass stripping in arable land, together with the building of dams, there are still great soil conservation problems. In many areas these works are not sufficient to halt soil erosion, especially as they are not being maintained and respected by the people. It is clear that much more than basic measures are necessary to halt soil erosion in the catchment, notwithstanding the present lack of maintenance of those basic measures. Proper land utilisation planning must eventually be introduced. The first step towards this began during the year under review, when work started on a land classification survey which is being linked with a census of persons and stock. Initial results of the survey show that approximately 7,800 acres of the land at present

ploughed by people in the valley should be closed to cultivation and that as much as 10,600 acres of the land used only for grazing must be closed to grazing. These are indications of what is necessary in order to rehabilitate this land and check soil erosion. How to achieve this in an area where there is already considered to be a serious pressure in human and stock populations, is a problem of great magnitude. It is possible that land use planning in the valley will have to be done in conjunction with the planning of a much larger unit area, of which the valley forms only a part.

Some repairs have been undertaken during the year to rectify and improve initial conservation works. In the Thota-peli catchment, below which there are fishponds, additional works are being constructed. In this catchment the chief has been advised also that a number of lands must be closed to cultivation. No progress has yet been made in getting the people of the valley to maintain anti-erosion works in their lands to any great extent. However, a new system is being started throughout the Territory, whereby District Councils will be responsible for this work; the system will also apply in the Pilot Project area.

(b) Tree Planting

The "village grant" scheme for planting rooted poplar cuttings in gulleys has not been continued this year. The reason is that chiefs and headmen have not taken steps to close to grazing the areas previously planted. The Paramount Chief has issued instructions that such areas must be demarcated and be completely closed to stock. The order is not being strictly enforced; consequently considerable damage has been done, especially by small stock in the winter months. The scheme will only be continued in areas where protection is guaranteed. Suspicion about the rights of ownership of trees planted in this way has always been a problem which interfered with the "village grant" scheme. The Pilot Project Local Committee has now agreed to visit all prominent chiefs and headmen in the area in order to encourage them to plant and protect trees. A few individuals continued to plant trees in protected areas. They obtained their trees from the nursery at Pilot Project Headquarters. The schools in the valley were active in planting trees in school tree planting areas; this work is done in order to teach the children about tree planting. There was also some demand for good quality fruit trees, which were purchased in the Union and resold to individuals. During the land classification survey, certain areas were selected for fenced tree plantations. No further success has been achieved in the growing of two types of basket willows; their development is slow, especially where there is not effective protection from stock.

(c) Grazing Control

A system of controlled rotational grazing for headmen's areas in the valley is still being encouraged. A few headmen realise its benefits and enforce it in their areas. The recent survey shows that good grazing is in very short supply. If proper land utilisation is ever to

become a reality a co-ordinated system of grazing control for every unit in the valley must be worked out and enforced by chiefs and headmen.

In the early spring there was a great deal of unauthorised veldt burning. This occurred all over Basutoland and was not limited to the valley. It was probably due to the good grass cover resulting from the very adequate rains of last summer. The people, unfortunately, do not realise the value of good grass cover. Some twenty-four areas in the valley were burnt. The extent of the burning was so great that, in most cases, it has been impossible to make the chiefs and headmen close the areas to grazing, in spite of strong orders issued by the Ward Chief.

(d) Improved Land Use

The land classification survey has already been mentioned. Until all the facts from this survey are known no new village removals are being recommended to the chieftainship. In places where removals have already been ordered there are still a number of persons who have not obeyed the order to remove. Steps are being taken to see that these removals are completed. Where lands are to be closed (e.g. the Khohlong catchment) it is no longer possible to recommend new areas for cultivation, because of the shortage of suitable land.

B. DEMONSTRATION

(a) Agricultural Extension Work

This work continues and an increasing number of the more progressive farmers are coming to the Pilot Project staff for advice and help in the use of kraal manure, ash, fertilizer, good seed, insecticides, etc. Each agricultural demonstrator is concentrating on working intensively with up to ten progressive farmers in his area. The intention is that these farmers' holdings will be an example to the other less progressive farmers. An indication of the success achieved in encouraging the use of insecticides is shown by the sale of seventy pint bottles of Psylortox, a D.D.T. preparation to combat maize stalk borer caterpillars. Pitsos (tribal gatherings) held personally by the Ward Chief, helped this work. Insecticide was sold at these gatherings and its use demonstrated. The Pilot Project Extension Team had a most successful extension work stand at the Maseru Central Show. Their work, illustrated by photographs and models, aroused much interest among the public.

(b) Sale of Fertilizer, Seed, Insecticides and Carts

This scheme, which began at Pilot Project, has now been extended on a territorial basis in the form of an Agricultural Department Trading Account. The turnover has already exceeded £6,000. Pilot Project, like each district, now draws its stocks for re-sale to farmers, through this account. The sales for the year in Pilot Project area only amounted to £168.

(c) Livestock Improvement

Five Brown Swiss bulls are run in various parts of the valley.

They are controlled by local headmen acting as custodians. Three of the bulls are run successfully in "closed herds". It is now possible to find a number of reasonably good progeny from these bulls in different parts of the area. The progeny is cross-bred out of a variety of local cows, but is, undoubtedly, a better type than produced by poor quality bulls. The Brown Swiss bulls were changed round during the year to guard against in-breeding. One custodian has really tried to improve his own herd. He has recently been selling twenty bottles of milk a day. Another has, unfortunately, sent some of his good progeny to a different part of Basutoland in order to pay dowry for the marriage of a son.

C. INVESTIGATION

(a) *Co-operative Mechanised Farming*

The experience gained in four seasons of trying to get groups of farmers formed into co-operative societies, to operate tractors, has revealed many problems. These have been explained in previous reports. In the 1957/58 season three of the four societies continued to operate but they were doing uneconomical hire work on scattered lands. The system of each tractor working approximately 250 acres of arable land in one compact block has had to be abandoned. During the second half of the year under review, steps were taken to try and re-establish the use of tractors in the original compact blocks. It was realised that probably the only way to achieve this was with the direct support of the chieftainship, which is the land allocating authority. The progressive farmers who wished to use the tractors properly and economically had already petitioned the Paramount Chief requesting that lands be reallocated so that any farmer with lands in the tractor blocks, who did not wish to use the tractor, should be given land elsewhere. At the beginning of the scheme when pre-payment of cultivation charges was not demanded, farmers with lands in the blocks had been willing to use the tractor. After harvest many never paid their charges.

The problem was discussed at length in the Pilot Project Inter-departmental Committee and a report from the Standing Committee of the Basutoland National Council on the subject of the use of tractors was also considered. Later, the Paramount Chief, with the support of the Resident Commissioner, issued a letter addressed to the Ward Chief on the proper use of tractors. The salient point made in this letter was that the Ward Chief should try to persuade members who had withdrawn from the groups to go back to them, otherwise the Ward Chief should have lands reallocated in such a way as to re-establish the former blocks of land, which were economic for tractor cultivation. It was also made clear that farmers must be prepared to pay their tractor charges in advance. The Ward Chief gave enthusiastic support to the Paramount Chief's instructions, after discussion of the matter in the Local Committee. The instructions were explained to the farmers who had lands in the blocks, at a series

of meetings held in the valley. The District Commissioner was present at these meetings.

Some success has been achieved in all four tractor groups, one of which was originally closed down. Almost all lands in the areas chosen for tractor farming have been ploughed by tractor, although in nearly all groups members were late in paying their charges. The charges were £1 per English acre for ploughing only, except in the 'Mesapela group which agreed to do three operations for £1 10s.—ploughing, planting and one cultivation. This latter group has been the most successful, although the committee agreed to a certain amount of work on credit for their members. The indication here is that some form of credit is necessary. The soil which this group works is not particularly fertile, being a sandy loam. This group was also subsidised with a small amount of fuel to encourage its members to use the tractor to take manure and ash to their lands prior to ploughing.

In all groups ploughing was not as efficient as might have been hoped for in that groups of lands within the blocks were ploughed together, rather than the whole block being ploughed as a unit. This was due to some farmers delaying in their payments. Nevertheless something has been accomplished and the principle of reallocation of lands, if necessary for a particular type of farming system, has been established. The tractors are now mainly confined to more economical work in the blocks established for tractor cultivation. In the groups which have agreed to do ploughing only for their members, the members use their own planters and oxen and do their own cultivation. Individuals who wish to do so can, however, hire the tractor for this work. The tractor can also be hired out to persons with lands outside the blocks if all group work has been completed. Very little hiring was done, however, this season.

In the few cases where the Ward Chief and Local Committee had to order a re-allocation of a man's land, as he did not wish to use the tractor, the man concerned usually had second thoughts and paid his tractor charges. The Ward Chief was strict and, in cases where a man had ploughed in the block with oxen without permission, he had to pay for his land to be reploughed by the tractor.

Crop germination (mainly maize and kaffir corn) has been fairly good in three groups, although some lands had to be replanted because of cutworm and maize beetle damage. The crops are, however, not so promising in the fourth group at Malimong. In all groups members are keen to weed and cultivate their lands and to use insecticide to prevent stalk borer. Farmers' days are being held in the blocks to encourage this.

There are many problems still to be solved in co-operative tractor farming. Not the least of these are the full use of the tractor for all operations, credit for the really poor farmer in order that he may pay his charges, early prepayment of charges, use of good seed and fertilizer, the need for regular general and committee meetings, the full payment of tractor repairs and the high degree of supervision

still needed by Pilot Project staff. It is probably that co-operative group farming is not the best system for using tractors in Basutoland because of the above difficulties. But tractors are needed by many farmers in order that they may plough at the right time when so often oxen are not available and in condition. The investigation so far carried out in Pilot Project over five years into the use of tractors has provided much useful information, not the least of which is the need for the support of the chieftainship, especially in the matter of land re-allocation. There was also a misunderstanding among the Basuto outside the Pilot Project area that the whole project was largely tractor farming. Efforts have been made to allay this, as the use of tractors is but one aspect of investigational work within the project. The following table gives an indication of the progress of the co-operative groups:—

<i>Name of Society</i>	<i>Area of lands ploughed 1957/58*</i>	<i>Area of lands ploughed 1958/59†</i>	<i>Society's monetary assets at 30/11/58</i>
Rampepe's ...	109 acres	108 acres	£217
Thaba-Chitja...	59 acres	157 acres	£99
'Mesapela ...	105 acres	108 acres	£113
Malimong ...	Nil	109 acres	£102

*Scattered lands. †Blocks of lands.

(b) *Fish Ponds*

The three ponds in the Khohlong catchment are being kept as a nursery for black bass. There are a number of large fish which can be removed but observations to date indicate that the culture of this type of fish does not justify any large economic fish farming scheme. Fish from the ponds have already been introduced into one or two suitable dams in the valley and are available for stocking dams outside the Pilot Project area. Many dams are not suitable for black bass as they are muddy and silting. For these dams carp are thought to be better. These fish are vegetation feeders. It is, therefore, easier to establish a good food supply for carp; black bass, being insect feeders, are not so easily provided for. No experiments in artificial feeding of the bass in the fishponds have yet been carried out, as technical advice is not, as yet, available in the Territory and the supply of water for the fishponds is not yet assured, due to the silting of the supply dam in the catchment. A few carp have been introduced into one other dam in the valley, but a nursery for this type of fish is planned for an area outside Pilot Project. Steps are being taken to obtain expert advice.

The investigation has shown that black bass thrive reasonably well in ponds. A certain amount of supervision is necessary to keep the ponds in proper condition. As this type of fish is carnivorous, there must be control of the size and numbers of the fish population.

(c) Other Trials

(1) Irrigation: No further work was undertaken during the year. Encouragement is given to individuals who want to lead water to their gardens by means of small furrows for watering vegetables.

(2) Hydrological Experiments: No further work has been attempted because of the lack of staff with experience in these matters.

(3) Crop Field Trials: A number of co-operative trials were carried out on farmers' lands to investigate the effect of trace elements. The work was supervised by staff from the Maseru Experiment Station. Results were disappointing and revealed that it is difficult to exercise a sufficient degree of control, as great care is essential in this type of experiment if the results are to be significant. The more straightforward co-operative fertilizer experiments carried out in previous years gave better results.

(4) Planned Headman's Area: This scheme was not continued as the final results of the social survey carried out in the area, although providing useful information, indicated that the area was not sufficiently large to plan properly. The people themselves were also suspicious of the scheme and showed no enthusiasm about it.

(5) Yield per acre of Reeds (*Phragmites Communis*): An interesting sampling experiment was carried out in the large reed bed which indicated the value of this plant which is used for thatching. It is also very useful in connection with soil conservation measures. The results of this experiment indicate that the yield from an average sample of reeds in the Tebetebeng Reed Bed is worth £24 per acre, reeds being costed at 2s. per bundle of 13 lb. average weight. This crop is obtained with little or no effort, except labour at harvest. It is, of course, a communal crop shared customarily between the people and the chief. If mealies were grown on similar soil a yield of 12 bags per acre might be expected in a good season. This is worth only about £18 per acre; much more work is needed and a crop is not guaranteed as in the case of reeds.

The sample area is now being treated with different types of fertilizer to try and discover how yields might be increased. The traditional Basuto system of trying to improve reed beds by allowing ploughing for a period leads, unfortunately, to the reed beds being permanently opened for cultivation and thereby diminished in size.

D. COMMUNITY DEVELOPMENT

The planting of trees and grass and simple conservation work done by the nine schools in the valley has continued. This work, together with gardening, was encouraged by organising an inter-schools competition for the second year. The standard of the work was judged, as before, by monthly visits to each school. Prizes were presented for the best work in each section and a cup was awarded to the school which earned the greatest number of points throughout. A formal prizegiving was held at Pilot Project Headquarters. The

standard of work, although previously high, again showed improvement. Many schools outside Pilot Project are interested in this work which is within the schools' syllabus and can be done with a certain amount of extra supervision by departmental staff in order to encourage and advise the teachers.

One village Young Farmers' Club has been started. It has a membership of about fifty children. These children all live in one large village. They are mostly attending three nearby schools, but a few of the children have not had the opportunity of schooling. The chief has allocated the Club one acre of ground for a garden where the members grow vegetables. Two small dams were made there and the children helped by planting kikuyu grass to protect the walls. They also protected the garden with pole fencing, where the aloe hedge was inadequate. They laid out the garden plots and planted fruit trees. The children do all the work themselves but they are visited regularly by the Pilot Project staff. The Club has its own committee and adults in the village are encouraged to take an interest in the Club. The children are very enthusiastic and some were instructed in how to judge at the District Agricultural Show. The Club has also visited the Agricultural Experiment Station at Maseru. A site has been chosen for a second club of this sort.

There has been a considerable demand for protected village springs. Twenty-two new ones have been constructed, bringing the total number of springs now protected in or near the valley to thirty-five. The villagers have helped in the construction of each new spring by contributing £1 towards the cost—also by supplying sand, stone and labour. The Extension Team helped in this work during its period of training at Pilot Project. The team, which consists of an Agricultural Development Officer and an Assistant Education Officer, has now started work in the district outside the Pilot Project area. The team is introducing to the people in the district agricultural extension work and community development work which has been found successful at Pilot Project. The team is working in Majara's Ward in Berea district. It is building village springs using District Council funds and concentrating on rodent destruction, use of insecticides, tree planting, improvement of vegetable gardens and work with the schools. This is a test of the personnel and the principles of extension work on these lines. The team is under the control of the District Commissioner, Berea, the Ward Chief and district team. The chiefs were enthusiastic and keen that the team should come to Majara's ward, but it remains to be seen how much the people will contribute themselves, in order to achieve some success in community development.

No new village planning has been embarked upon in view of the need to have full information on land utilisation before village sites are finally chosen. The aim at present is to ensure that the villages already ordered to move are successfully established on the new sites chosen for them.

Roads and tracks in the valley were badly damaged by the heavy rains of last year. The Basuto National Treasury made a small additional grant from local rate funds to help in repair work. Two tractors were hired in the slack season from the mechanised group farming co-operative societies at a nominal rate and paid for from the grant. The tractors were used to haul stone. The state of the track to the head of the valley made it impossible for the medical officer to run a dispensary there and a temporary building lent by the villagers is being used for the dispensary at a more accessible point. The medical officer has made fortnightly visits and twenty-seven clinics were held during the year at which 1,460 patients were examined. It is planned to erect permanent dispensary buildings, including quarters for a nurse at or near this more accessible point. The medical officer is now to make weekly visits and when a nurse is eventually stationed at the dispensary it is hoped she will hold a weekly clinic at the head of the valley where the original dispensary rondavels have been built. She could travel there on horseback. There is an African nurse now employed to do maternity work by the Red Cross. She is stationed at Pilot Project Headquarters and helps to run a most successful baby clinic at which the best attendance was forty-five mothers and babies. There were 740 attendances of mothers with babies at the clinic during the year. She also assists the medical officer when he holds his dispensary further up the valley.

The Tebetebeng Farmers Co-operative Society is broadening its activities. It has been granted limited credit facilities for the purchase of goods through the Co-operative Banking Union, of which it is a member. Late in the season the society's members sold a quantity of grain, also through the Union. This created considerable interest and the sale of grain should increase next season. An attempt to arrange for the members to sell stock was not so successful. Stock offered for sale was not in good condition and prices did not tempt the sellers to part with their animals. Despite these increased activities the society's committee is not yet taking sufficient interest and responsibility. There has been a second theft of the society's funds but it seems that the culprit only got away with a few shillings this time.

Some emphasis has been laid on encouraging the women to play a more active part in community life and especially in applying better methods in agriculture. To this end a Home Makers' Association has been started in one area and the Red Cross Association are having a small garden competition for mothers of children attending the baby clinic.

Success in community development work is still very small. What has been achieved is little more than an example of what could be done if the people realised more fully the need to make a greater contribution themselves, in cash, material or by voluntary labour.

E. OTHER ASPECTS

(a) Publicity

A number of visitors, including the Paramount Chief and parties of school children, came to see the scheme during the year. Unfortunately no News Letter could be published during the year because of the need to concentrate on getting projects started in the field. It is planned that a news sheet should be issued, written in English and the vernacular, with emphasis on contributions by the African staff.

(b) Staff

There have been no changes in staff since last year. The Officer in Charge and the Agricultural Officer have learnt to know the area and many of the people, with the help of the African Development Officer and his demonstrators. A new demonstrator was sent to the upper part of the valley in September to fill a post which had been vacant for several months. More departmental technical officers have visited the scheme in order to give advice. The Officer in Charge had additional administrative duties while acting District Commissioner for four months of the year, and also attended the SARCCUS meeting in Portuguese East Africa.

(c) Communications

The bad state of repair of the road of access to the scheme from district headquarters eleven miles away has been a constant problem and a limiting factor in the work which could be undertaken at Pilot Project. Unfortunately no provision was made at the start of the scheme for a reasonable all-weather road. The road had had little or no money spent on it, as it was only maintained through a small Government subsidy paid to a local trader. However, it has at last been agreed that the road should become a Public Works Department responsibility. Work has started with picks, shovels and wheelbarrows, but the problem is that, in many places, the road is below the level of adjacent arable lands, and is a water-course rather than a highway.

F. ECONOMIC AND SOCIOLOGICAL ASPECTS

Under the revised scheme estimated expenditure from Colonial Development and Welfare funds for the period 1954 to 1960 is £78,524. Capital amounts to £14,514, Personal Emoluments £38,358 and Other Charges £25,652. Only a very small proportion of the cost is borne by the people concerned. This had been made clear in previous reports.

No great economic advancement has been achieved in the area but individuals who have appreciated the value of the new ideas which have been introduced are benefitting. There is no doubt that the scheme is of value in introducing new ideas to the people of Basutoland and it aims at stimulating a demand for improved agricultural methods and living conditions. It has also showed the difficulties of achieving these aims under existing tribal conditions.

The Inter-Departmental Committee continues to keep under review the work being done, and especially those aspects of the scheme which affect territorial and departmental planning. The Paramount Chief is represented on this Committee. The Pilot Project Local Committee, of which the Ward Chief is chairman, held nineteen meetings and worked as a committee in the field. It has had notable success in ensuring close liaison between the chieftainship, the scheme and district administration. The Committee's work has illustrated that it is necessary for the chieftainship to give support to all development work, if any degree of success is to be obtained. The chieftainship is still respected, despite some human failings, and is as yet the one and only authority in rural areas.

G. CONCLUSION

As stated in previous reports it is still a very big and long-term task to persuade the majority of the people to accept new ideas and to work harder. Where success has been achieved it has usually been in the more simple schemes started in the Project, e.g. protected village springs. The people are asking for assistance in this type of work and progress in such simple things is the foundation for more advanced and extensive development, which, it is hoped, the people will learn to want eventually. It must be accepted that the tempo of rural development is slow among the people in Basutoland. New ideas are treated with suspicion. Consideration is, therefore, being given to a plan to continue to use the Tebetebeng valley after 1960, when the present scheme ends, as a focal point for continuing the introduction of new ideas and new practices to the people of Basutoland and to demonstrate also the difficulties which are met in development work. The plan, if accepted, will lead to the complete integration of the Pilot Project area with Berea district. The area will be considered as a district development area where a small concentration of staff can carry on development work financed on a very moderate scale from central and local government funds. It can be said that the people have come to regard Pilot Project as a development area and it is logical that work there, which has attracted the attention of the public, should continue despite the apparent slow rate of progress. In a conservative society changes can only be brought about slowly, and with perseverance.

D. H. TAYLOR,
District Officer in Charge.

PART III

SECTION I

CROP PRODUCTION AND FOOD SUPPLIES

The seasons in Basutoland are, broadly speaking, as follows:—

September-November ...	Spring ...	Rains commence.
November-April ...	Summer ...	Growing season. Rains.
April-June ...	Autumn ...	Harvesting. Frost commences.
June-September ...	Winter ...	Cold dry seasons. Heavy frost.

(1) Export-Import of Foodstuffs

The following table shows the export figures for the main crops, these being quantities of foodstuffs for which permits for export to the Union of South Africa have been issued:—

	1953	1954	1955	1956	1957	1958
Wheat ...	38,629	54,478	27,575	82,114	101,077	51,741
Peas and Beans...	25,967	54,160	39,677	62,943	47,300	38,608
Sorghums and						
Malts...	57,951	17,371	10,168	5,643	10,003	11,864

At Appendix II is given the monthly imports of maize with comparative averages over the last nine years.

£26,843 was paid to the Union Government as a refund of Union consumer's subsidy in respect of the 107,899 bags of maize imported into the Territory. The Union maize producer is subsidised to the extent of 5s. per bag. This subsidy is, naturally, repayable by any country importing maize from the Union.

(2) Maize and Sorghums

1957/58. Because maize as a porridge and sorghum in the form of beer form the basis of the diet of the Basuto there is a considerable acreage of these crops planted in the lowlands, foothills and even in the warmer mountain valleys. In the latter areas, because of unpredictable weather conditions, a farmer is lucky if he reaps a full crop once in five or six years. Difficult transport conditions encourage production in mountainous areas which are climatically not suitable for the growing of these crops.

The 1957/58 crop of maize gave average results in the lowlands but once again yields would have been higher had people treated against stalk borer and carried out timely cultivation. Sorghum yields were above average and prices were reasonably good, being limited by the Union's floor price scheme. The average price paid to producers for a 200-lb. bag of maize was 30s., and for sorghums 35s.

Mountain wheat has, again, been promising and should yield well provided it is not adversely affected by early frosts. At no time has there been much damage from wheat lice (aphid attack), a pest which has devastated neighbouring wheat crops in the Union.

The low stocks of local wheat afford an opportunity for the depart-

ment to introduce clean, good seed varieties, and this is being exploited as far as possible.

SECTION II

LIVESTOCK INDUSTRY

1. ECONOMIC ASPECT

The year has been a good one. Good rains in the late summer and early autumn ensured good grazing during the winter months and the stock wintered well. The drought in the early spring and the excessive burning by the farmers of reserved grazing did not cause any appreciable stock losses and, at time of writing, the stock are in fair condition. More rain is, however, urgently needed to promote growth of crops and pastures during the coming season.

2. AUCTION SALES

Departmental auction sales were held at Qacha's Nek during the year and were well patronised. At these sales 832 cattle and 568 sheep were sold. The average price per beast realised was, cattle £24 and sheep £2 15s. 6d.

Sales of cattle were also organised by Co-operative Societies in the districts of Mokhotlong, Butha Buthe, Mafeteng, Leribe, Semonkong, Mohaleshoek, Quthing and Matelile.

In all 17 sales were held and cattle were bought on a weight basis using a weigh-band. The higher grades were sent to Union abattoirs, while animals which were suitable for compound meat but which were not used as such were sent to a canning factory.

At the sales cattle were sold at an average price of £22. Although the prices offered were on the low side, these sales have served a very useful purpose in promoting competition and permitting owners to dispose of animals at centres where selling facilities had not been previously available. It is hoped that these sales will continue.

During the year Basutoland exported the following livestock:—16,780, estimated value £260,000, and imported 21,897, estimated value £300,000—an adverse balance of £40,000.

3. WOOL AND MOHAIR

SHEEP AND WOOL

Wool Clip

Another good season was experienced apart from a dry winter which pulled the small stock down in condition and adversely affected the winter clip. Good spring and summer rains, with their consequent improvement of grazing, soon put matters right.

The classing of wool within Basutoland has not been up to the standard of previous years with the result that wool forwarded to brokers at the coast for sale has been withdrawn by Union inspectors. Every attempt is being made to improve the standard of classing by ensuring that traders insist upon satisfactory classing prior to export

and that wool classers are suitably efficient before being granted a wool classers certificate.

A revised wool and mohair policy with the necessary alterations to existing legislation is envisaged, aimed primarily at attempting to improve the get-up of our clip.

The average price of wool sold by auction at the coast during January was 31.2d. per pound. This fell steadily month by month until the average price for May, the last month of the wool-selling season, was down to 21.89d. per lb.

The new season opened in September at the even lower level of 16.79d. per pound. The abnormal amount of very short and dusty wool offered adversely affected the opening price. Had it not been for the protection offered by the South African Wool Board's stabilisation scheme, values would have been even lower.

In October the demand improved and prices rose by nearly 9%. There was a further $8\frac{1}{2}\%$ rise in November and yet a further $5\frac{1}{3}\%$, bringing the closing price for the year to 20.92d. per pound, a figure well above the Wool Board's floor prices.

This steady rise in Basutoland prices from September to December is significant in view of the fluctuations in the Union market as a whole, which showed a decided downward trend in December.

The overall weighted average price realised by Basuto wool at the coast during 1958 was 23.21d. per pound as against 40.94d. the previous year. This represents a fall of 43.31%.

The future of the wool market is obscure.

Duty was paid on 6,289,004 lb. of wool exported from Basutoland in 1958 compared with 7,058,431 in 1957, a decrease of 769,427 lb., or 10.9%. As preliminary census figures show no appreciable decrease in sheep numbers and the season was fairly good it can only be surmised that this further decrease in our legal exports is due to increased smuggling over the border to avoid wool export duty and to obtain the higher prices obtainable because of this evasion. On the basis of an average of 23.21d. per pound Basutoland's legal wool exports were worth £608,199 at the coast, £595,851 less than last year.

Sheep Improvement

Two hundred and forty-five Merino rams, most of which have been sold, were introduced from the Union for sale to Basuto flock owners at subsidised rates. This was less than half the number imported in 1957, due in some measure to the depressed state of the wool market. A total of 15,207 rams have been imported into Basutoland since the inception of the scheme in 1935.

The campaign aimed at the elimination of the undesirable ram is continuing with varying success but will not be entirely successful until castration on the spot of bastard rams is once more permitted.

Wool Classing

Refresher courses were held for wool classing instructors at the beginning of the wool season and were followed up by training and

refresher courses throughout the districts. These were on the whole well attended by Government and traders' classers and by a few Basuto farmers. Lectures and demonstrations were given to flock owners by the Wool and Mohair Officer whenever possible.

The erection of wool sheds has been temporarily halted as it is felt that those in existence are not being used to the full.

4. GOATS AND MOHAIR

Mohair Clip

The mohair selling season opened in March with an average price of 43.96d. per pound, 27.21% lower than at the close of the previous season. This low level was maintained until a sharp rise in July raised it to 53.41d. As this was regarded by the trade as being artificially high no surprise was felt when the market eased to 49.61d. in August and 45.89d. in September. After that, however, prices rose steeply to an average of 67.44d. for December. This was 7d. above the closing prices of the 1957 season.

The overall weighted average price of Basuto mohair sold by auction at the coast during 1958 was 53.98d. per pound compared with 79.12d. in 1957. This represents a drop of 31.77%.

This has been a satisfactory season for buyers and brokers with prices improving as the season advanced. It remains to be seen at what level the next season will open in March.

The preparation of our mohair clip still leaves a lot to be desired.

Duty was paid on 991,999 lb. of mohair exported in 1958 as against 1,056,066 lb. the previous year. This is a decrease of 64,067 lb. or 6.07%. As in the case of wool, smuggling is thought to be the main factor in this decline. On the basis of 53.98d. per pound legal mohair exports were worth £223,117 at the coast, £125,032 less than last year.

Goat Improvement

Two hundred and eighty-one Angora rams were introduced from the Union for sale to flock owners at subsidised rates. This is 58 more than in the previous year. The total of rams imported to date is 2,148.

The elimination of undesirable rams is still being aimed at.

Mohair Classing

Refresher courses were held by the Wool and Mohair Officer for mohair classing instructors in May and were followed up by training and refresher courses throughout the Territory. Very few Basuto flock owners attended.

General

It is increasingly evident that some of our wools are well on the way to becoming "speciality" lines on account of their fineness, softness of texture and felting properties. This applies particularly to the six to eight months fleece line which is sought after by the German hosiery trade, and the four to six months used by the felting trade.

This interest on the part of the buyers can be maintained only if our mohair is classed to their satisfaction.

Maseru Agricultural School

As in past years the Wool and Mohair Officer lectured to students in wool and mohair and general management of flocks. This was followed up as far as possible by practical work. Demonstration and experimental Merino and Angora flocks housed at the Experiment Farm are being established this financial year and will be of great value in the training of students.

Liaison with the Union

The Wool and Mohair Officer paid a visit to each of the three ports handling Basutoland wool and mohair, namely Durban, Port Elizabeth and East London, where the get-up of our two clips was inspected and constructive talks held with brokers, buyers and Union officials.

Four meetings of the South African Wool Board in Pretoria were attended by the same officer in his capacity as Basutoland advisory member.

5. HIDES AND SKINS

Only very slight progress has been made. The donation of a very generous prize—a cow and a calf—for the best hide shown by a farmer at the Central Show stimulated great interest, but until there is a general insistence on improved hides and skins by the traders and the price paid to the producer is in keeping with the quality of the product, little progress will be made.

During the year a company was formed to deal in these hides and it is to be hoped that its activities will result in steady improvement. Every encouragement has been given to this company to advertise its objectives through the departmental staff.

6. TATTOOING AND REGISTRATION

This has continued during the year. This duty has now been given to the higher paid Assistant and Temporary Assistant Demonstrators in charge of tank areas, and will continue to be carried out twice yearly. It is hoped that this change will ensure the maintenance of better records. Checks have shown that the method of tattooing is effective, especially in small stock, but that difficulty is frequently experienced in reading the marks due to faulty placing of the tattoo in the haired or wooled portions of the ear. However, these marks are now generally recognised and are serving a most useful purpose as a means of identifying stray and stolen stock.

7. EQUINE IMPROVEMENT

The Agnes Mary Young Memorial Stud has continued to make steady progress. During the year thirteen foals were born, but of these eleven were fillies and only two colts.

The stud now consists of:—

1 Stallion—“Silver Eagle”.
20 Mares.
33 Fillies.
11 Colts.

In addition, twenty stallions, mainly sons of “Silver Eagle”, are now standing at stud throughout Basutoland, and are placed as follows:—

Maseru	...	...	6
Mafeteng	...	...	3
Mohale's Hoek	...	...	3
Quthing	...	...	2
Qacha's Nek	...	...	1
Mokhotlong	...	...	2
Butha Buthe	...	...	1
Leribe	...	...	1
Teyateyaneng	...	...	1

Of these ten are in Government stud stables and ten are placed with custodians. These stallions are being well cared for and have been much admired. The demand for their services is increasing.

Unfortunately, during the year, one mare, “Julia”, and two fillies died. Two of these deaths could have been prevented had skilled veterinary attention been available immediately. A further four mares aborted during the year. This can be attributed to the poor grazing and also to the increasing age of the stallion.

Owing to the growth of the stud, which now numbers some sixty-five horses, the grazing available in Maseru has proved hopelessly inadequate and it has been decided to transfer part of the stud to Quthing. To date twenty-three fillies have been sent there and a further two stallions, six mares and six fillies will be sent early in 1959. This section of the stud will be run on the old Nkoni Cattle Farm on the Quthing reserve, and will be under the care of Veterinary Assistant P. Koloti, who has been in charge of the Agnes Mary Young Memorial Stud in Maseru. Stallion “Sir Valiant” will be the sire of the Quthing section of the stud, while the “Silver Eagle” stud—consisting of the fourteen best mares and six of his selected daughters, will remain at Maseru, during his period of useful service, unfortunately now drawing to a close as he is approximately twenty-one years old. After his retirement it is the intention to move all the remaining mares and fillies to Quthing into one stud.

8. CATTLE IMPROVEMENT

A further seven Brown Swiss bulls have been placed during the year as follows:—

Qacha's Nek	...	...	1
Quthing	...	...	1
Maseru	...	...	2
Berea	...	...	2
Leribe	...	...	1

The demand for these bulls is increasing and it is hoped to place a larger number next year. On a recent visit to Pilot Project, which has five bulls in a small area, an attempt was made to assess the value of the bulls. Unfortunately one of the custodians has used all the Brown Swiss progeny for lobola purposes, while another has sold all his because of the good prices being offered at sales. The calves, young bulls and heifers seen were encouraging but no assessment of real value will be possible until the progeny of these heifers are available.

SECTION III

VETERINARY

1. ANIMAL HEALTH

From the veterinary aspect the year 1958 has been a good one. No major epizootics occurred during the year and the stock remained relatively free from disease.

This year, too, has been an eventful one in that the appointment of 100 Small Stock Assistants and nine Supervisors has brought about the re-establishment of a veterinary division able to tackle immediate problems without interfering with other departmental activities. These men are paid from Wool and Mohair Funds and will, in the first instance, be responsible for the regular monthly dosing of small stock. The figures to date indicate that a much greater percentage of our small stock is now being regularly dosed and this can have nothing but beneficial effects on the health of the stock and the quality of our wool and mohair.

These men will work under the direct supervision of the veterinary assistants and, as their efficiency increases, it is hoped to train them to undertake further duties such as the dipping of small stock, mange treatment, protective inoculation and general veterinary investigational work.

2. SMEAR EXAMINATIONS

During the year 108 smears were examined with the following results:—

Anthrax	...	...	...	2
Quarter Evil	...	...	...	4
Anaplasmosis	...	...	...	1
Piroplasmosis (Bovine)	...	...	...	1
Biliary Fever (Equine)	...	...	...	1
Biliary Fever (Canine)	...	...	...	12
Negative	...	...	...	87
				108

3. SCHEDULED DISEASES

(1) Anthrax

There were two outbreaks of anthrax during the year; one in Maseru and one in Leribe. The in-contact cattle were inoculated immediately and no extension of the outbreak occurred.

During the year 38,000 doses of vaccine were used, the bulk of this being used for the routine inoculation of cattle imported.

(2) Quarter Evil

Twenty-two outbreaks of quarter evil were reported during the year, the distribution being as follows:—

Maseru	...	...	4
Mafeteng	...	...	2
Mohale's Hoek	...	...	2
Qacha's Nek	...	...	12
Leribe	...	...	2

The stock owners themselves make good use of the vaccine, especially before sending their cattle to the mountains for summer grazing, and some 12,000 doses of vaccine were supplied.

(3) Equine Mange

The position as regards this disease remains unchanged. It is widespread and the sporadic treatment at present available will do little to bring it under control. It is hoped that with the appointment of 100 Small Stock Assistants it may be possible to tackle this on a territorial simultaneous basis.

(4) Mange in other Livestock

Two cases of goat mange were reported—one in the Maseru area and the other in Mafeteng. Dipping of the affected flock brought the disease under control and there has been no spread.

(5) Lumpy Skin Disease

Having been present during the period from November, 1956, until the end of 1957, the disease has now, apparently, disappeared and no cases have been reported this year. The disease is, however, present in the Orange Free State and Natal and extensions to Basutoland are possible at any time.

(6) Rabies

No outbreaks have been recorded. The position in the neighbouring areas of the Free State is being closely watched. Four dogs and cats intended for export to other African territories were immunised against rabies during the year.

(7) Foot and Mouth

The continued presence of foot and mouth on the Molopo boundary between Bechuanaland Protectorate and the Union is disturbing and, with the constant movement of cattle between the Orange Free State and Basutoland, an extension to this Territory is not beyond the

bounds of possibility. Close liaison has been and will be maintained with the Union veterinary authorities.

(8) Other Scheduled Diseases

Did not occur during the year.

4. NON-SCHEDULED DISEASES

(1) Anaplasmosis and Piroplasmosis

Gallsickness was relatively prevalent during the year and red-water was also seen on a number of occasions. Ticks have been more prevalent this year than at any time in "living memory". This is attributable to the excellent seasons experienced since 1956 and to the good grass growth. Then, too, the last winter was, unfortunately, mild, and ticks remained active throughout the year. Owing to the relative freedom from these pests in the past, Basutoland has not been forced to resort to any control measures, and no dipping facilities are available. Hand-dressing has been the only method of control. Five hundred and fifty-seven doses of gallsickness vaccine were used during the year.

(2) Strangles

There have been the usual outbreaks. Again the benign form was encountered and no losses were recorded.

(3) Biliary

Several cases of biliary were recorded during the year and two horses were lost from this disease in spite of treatment.

Biliary in dogs has been very prevalent and the peracute form of the disease was prevalent at the end of summer and through to the end of the year. Several cases failed to respond to treatment and many dogs were lost, while others showed one, two or even more relapses. As mentioned before, ticks were prevalent and control has proved a problem. B.H.C. and other tickicidal dog-washes are effective but too frequent use normally causes eczema or other skin conditions.

(4) (Tetanus)

Has not been seen during the year.

(5) Verminosis

Although progress has been made with the campaign to control internal parasites, this was not satisfactory and, in October of this year, 100 Small Stock Assistants were appointed to take over this work. Each assistant is in charge of two tank areas and has been given a programme which will allow him not only to visit all the dosing centres each month but will give him time to follow up absentees each time. This was not possible in the past and the comparative failure of the dosing campaign can largely be attributed to the fact that the Tank Area Supervisors responsible were also expected to do

wool and mohair classing, mange treatment, tattooing and registration, and even agricultural duties such as tree planting and donga beaconing. This dosing is now their sole duty and, with proper supervision, it should be possible to dose practically 100% of the small stock. These men are responsible to the district veterinary assistant and early indications are that the efficiency is increasing. Dosing returns show that the efficiency varied from 30% in January, 1958, to 60% in December, 1958.

(6) Poisoning

There were the usual number of deaths from seneciosis but no other deaths from poisons or poisonous plants have been recorded.

(7) Horsesickness

Very few losses were recorded. During the year 1,700 doses of vaccine were issued.

(8) Bluetongue

Five cases were reported and 8,200 doses of vaccine were used during the year.

(9) Enterotoxaemia

Has not been recorded and 1,350 doses of vaccine were used.

(10) Distemper

This disease was prevalent during the winter and, towards the end, many cases of nervous distemper were seen. Response to treatment was very poor indeed and several cases died as a result. Thirty-eight doses of distemper vaccine were used.

(11) Feline Enteritis

A minor epizootic was recorded from Mohale's Hoek but, as this was not reported by the owner, no treatment was undertaken. No vaccine was used.

(12) Infectious Infertility

No cases were reported but, as infertility based on climatic and dietetic conditions is rife in this Territory, it is not likely that any such cases would be observed.

(13) Poultry Diseases

(i) B.W.D. AND FOWL TYPHOID. Several outbreaks were reported during the year and, in September, the disease broke out in the poultry plant at the Maseru Experimental Farm. As pullets are sent out from this farm to the whole of Basutoland it was decided to suspend distribution, slaughter off existing stock and replace after a suitable interval with fresh stock. This has been done, but sales of poultry will not be resumed until the spring of next year. It is considered that the disease reached the plant through misuse of the incubator and brooder house. Nine thousand, five hundred doses of vaccine were used during the year.

(ii) FOWL POX. Few cases were seen during the year and 1,950 doses of vaccine were issued.

(iii) COCCIDIOSIS. Few cases were reported.

5. GENERAL

The veterinary division has been at half professional strength again during the year, Dr. Raditapole having been seconded to Ghana during February. Dr. D. C. L. Wachter has been appointed to the vacant post and is expected to assume duty in the New Year.

In the absence of the Veterinary Officer and the frequent absence from Maseru on duty of the Principal Veterinary Officer, the responsibility for the clinical work in Maseru and the supervision and maintenance of the stud has largely devolved on Senior Veterinary Assistant T. Motsamai and Veterinary Assistant P. Koloti. I take this opportunity to express to them both my thanks for the exemplary manner in which they rose to the occasion and for the excellent work they have performed.

During the year about 2,600 cases were treated at the Veterinary Clinic, ranging from major surgical operations to the treatment of skin conditions and minor wounds. Revenue collected in respect of services rendered and drugs supplied amounted to £770.

The District Veterinary Assistant concentrates mainly on disease control work and the supervision of dosing. A certain amount of clinical work is done and fees accruing from this and the sale of drugs amounted to £580.

P. H. BROWN,
Principal Veterinary Officer.

SECTION IV

SOIL CONSERVATION

General

The new reorganisation of gangs in the field by building up fewer and larger units has proved most satisfactory and work has generally made good progress—this in spite of having to retrace our steps for the purpose of effecting large scale repairs to works damaged by the previous season's heavy rains.

Breakdown of equipment still remains a problem but, thanks to a fine effort on the part of the workshops staff, delays have been reduced to a minimum. Staff changes involving the replacement of the two Assistant Soil Conservation Officers by new officers when their contracts expired has caused one or two minor problems, but work generally has not been adversely affected. The appointment of a third Assistant Soil Conservation Officer for the supervision of concrete construction in the field should enable this aspect of the work to speed up considerably.

Buffer Stripping

This operation, as a major campaign, is now complete. Only £16 was spent on buffer strips this year when fifteen acres were protected.

Terraces

The tractor units have made good progress in spite of the fact

that over half their time was occupied on repairs to previously completed works. £6,319 was spent on new terraces, which amount to over 410 miles, while £2,770 had to be spent on repairs to old works damaged by flood.

Diversion Furrows

This aspect of anti-erosion work in the mountains has been discontinued until the meadow stripping has been completed and disposal thereby provided for the runoff.

Meadow Stripping and Donga Beacons

Whereas donga beacons in its old form has been discontinued meadow stripping has been applied to cultivated areas in the mountains and 565 miles of meadow strips have been laid out.

Most of the meadow strips laid out last year were destroyed by the farmers and work done this year has been concentrated on replacing those so destroyed.

All labour in this connection has been provided by the local chiefs and no expenses have had to be borne by the scheme. Progress has therefore been very bad as it was originally anticipated that work would have been completed during this year.

Dam Construction

This year our tractors constructed thirty-one large dams with a total capacity of over 11,500,000 gallons at a cost of £4,021.

Four more concrete weirs and inlets have been completed and work is commencing on a large multiple arch silt storage weir.

Tree Planting

Although slight improvement is shown over last year's figures, progress has been below expectations. This poor result is largely due to very poor nursery production where heavy losses were sustained due to adverse weather conditions. Many young trees were drowned by the heavy rains that fell last summer.

An encouraging feature in the tree-planting work is the increased financial assistance afforded the work by the Basuto National Treasury. Over £3,000 was made available by the territory for this work and has largely been used to cover labour costs.

The fencing programme has been stepped up and nine miles of fencing has been erected to protect tree plantations.

Land Use Planning

(a) TAUNG REHABILITATION SCHEME. Work proceeds more or less according to plan in this area but the tempo of physical progress on the ground has been slowed down. This is mainly due to the fact that the stage has now been reached when the department has had to make certain recommendations which are not popular with the chiefs and people who, in consequence, are putting up very strong opposition.

The closing off of reclamation areas has been completed and the initial phase of grazing control on all mountain slopes has been applied with extremely good results. The recommended stock reduction has

been very well applied by the local authority and all small stock were removed from the ward for the whole of the summer. A good proportion of the large stock accompanied the small stock to the mountains and this considerably lightened the grazing concentration in the ward.

Earth-moving equipment in the ward is now up to strength and is fully occupied on contouring and dam construction. The two major dams which are to supply the Rietvlei field nursery with water are just about complete and a constant supply of water is now assured, which will greatly help tree production in the future.

Plots have been established in the ward for investigating the reclamation of denuded areas by a combination of ripping, fencing and seeding to *eragrostis curvula* grass. The results will only be fully apparent after one or two seasons, but present results are most encouraging. (See photographs.)

The rehabilitation of the arable areas has been held up and no progress has been made with the intended land realignment and reallocation. This is due mainly to an understandable reluctance on the part of the people to co-operate.

(b) TEBETEBENG CATCHMENT. A land survey was carried out in this valley of 41,000 acres in order to examine the possibility of applying land use planning and rehabilitation to the area.

The figures reveal, however, that it would not be advisable to consider this area as an independent unit within the Mamathe Ward in which it lies but rather to include it in a plan for the whole ward.

Some very interesting information has been gained from this survey, however, which has revealed how very badly eroded this type of country is.

Reference to the tables at the end of this report will serve to reveal these facts in relation to other investigations carried out in the south.

(c) CALEDON RIVER (River boundary between Basutoland and Orange Free State). As a result of the cutting off of certain lands by Caledon flood waters a survey of the Basutoland bank of the Caledon River was carried out to prepare a scheme for the protection of this bank against further erosion and the use of the bank for timber and reed production.

The final report on this scheme has not as yet been drawn up as the survey has still to be extended to the Makhaleng and Orange Rivers where they, in turn, constitute the border between Basutoland and the Union of South Africa.

However, figures relating to this survey are available at the end of this report and reference to them will prove of interest.

(d) OX BOW CATCHMENT. Several treks have been conducted in this very important area resulting in a plan for the control of grazing in this catchment.

Basically the catchment consists of three tank areas which make up a total area of 120 square miles. (They include the whole of the catchment).

Each tank area has been divided into three grazing blocks to be rotated on the system of one complete and two half seasonal rests every three years. The stocking rate has been fixed at 40% potential thus allowing one livestock unit to twenty acres.

The whole scheme is in the discussion stage but it is hoped that it will soon be operational as a pilot scheme for grazing control throughout the mountain areas.

Information relating to tank areas throughout the territory is being gathered from all districts to be used in the development of this proposed territorial scheme.

Conclusion

It has become apparent to this department that the solution of the erosion problem is not to be found in mechanical structures alone but in the reorganisation of the land use system in force in the territory today.

This new approach will of necessity be rather unspectacular in its rate of physical development but it promises to bear fruit of a more permanent nature than has been the case to date.

There has to be a complete union of sociological and technical procedures if any measure of success is to be achieved.

Working hand in hand with these two vital issues is the need for improved methods for the dissemination of information, the training of staff and farmers and the general enlightenment of the public.

Production Table for 1958

		<i>Prior to</i> 1958	<i>During</i> 1958	<i>Total to</i> <i>December</i> 1958
Area Terraced (acres) ...	...	478,569	8,229	486,798
Length of Terraces (miles) ...	...	25,964	410	26,374
Buffer Strips (acres) ...	...	687,837	15	687,852
Diversion Furrows (miles) ...	...	3,951	—	3,951
Dams Constructed ...	...	541	31	572
Concrete Weirs ...	...	2	4	6
Trees Planted ...	...	1,487,676	411,101	1,605,817
Dongas Beaoned (miles) ...	...	5,368	25	5,393
Meadow Strips (miles) ...	...	718	565	1,283
Reclamation Beaoning (acres) ...	...	13,296	—	13,296

S. H. YOUTHED,

Soil Conservation Officer.

Some Facts and Figures on Soil Erosion in Basutoland Lowlands

TABLE I. TAUNG WARD GROUND ANALYSIS (102,333 acres)

<i>Category</i>	<i>Acreage</i>	<i>Percentage of Ward</i>
Open Arable ...	43,529	42%
Closed Arable ...	13,296	13%
Open Grazing ...	10,956	13%
Closed Grazing ...	34,552	32%

TABLE II. TEBETEBENG CATCHMENT GROUND ANALYSIS (41,498 acres)

<i>Category</i>	<i>Acreage</i>	<i>Percentage of Catchment</i>
Open Arable ...	12,436	30%
Closed Arable ...	7,821	19%
Open Grazing ...	2,534	6%
Closed Grazing ...	10,643	26%
Reed Beds ...	640	1.4%
Exposed Sandstone	7,424	18%

TABLE III. COMPARISON OF TAUNG AND TEBETEBENG

(a) *Based on percentage of total area:*

<i>Category</i>	<i>Tebetebeng</i>	<i>Taung</i>
Open Arable ...	30	42
Closed Arable ...	19	13
Open Grazing ...	7	13
Closed Grazing ...	44	32

(b) *Based on percentage of Ecological Zone:*

<i>Category</i>	<i>Tebetebeng</i>	<i>Taung</i>
Open Arable ...	60	75
Closed Arable ...	40	25
Open Grazing ...	12	29
Closed Grazing ...	88	71

TABLE IV. CALEDON RIVER SURVEY

Total length of river	227 miles
Length under broad beaconing	67 miles
Length under simple beaconing	148 miles
Length in Reserves... ..	12 miles

TABLE V. PERCENTAGE BROAD BEACONING PER DISTRICT

Butha Buthe ...	54%
Leribe ...	26%
Teyateyaneng ...	25%
Maseru ...	21%
Mafeteng ...	12½%

TABLE VI. AREA OF LANDS CLOSED

(a) *Broad Beaconing:*

<i>District</i>	<i>Mileage</i>	<i>Land acreage</i>	<i>Total acreage area closed</i>
Butha Buthe ...	27	491	1,964
Leribe ...	23	400	1,600
Teyateyaneng ...	6	109	435
Maseru ...	7	127	510
Mafeteng ...	4	73	290
Total ...	<u>67</u>	<u>1,200</u>	<u>4,799</u>

(b) *Simple Beacons* (10-20 yds.):

<i>District</i>	<i>Mileage</i>	<i>Acreage</i>
Butha Buthe ...	22	80
Leribe ...	62	338
Teyateyaneng ...	18	98
Maseru ...	18	98
Mafeteng ...	28	153
Total ...	<u>148</u>	<u>767</u>

TABLE VII. TREE PLANTING IN BEACONED AREAS

<i>District</i>	<i>Broad Beacons</i>	<i>Simple Beacons</i>
Butha Buthe ...	300,000	40,000
Leribe ...	250,000	170,000
Teyateyaneng ...	72,500	50,000
Maseru ...	85,000	50,000
Mafeteng ...	50,000	75,000
Total ...	<u>757,500</u>	<u>385,000</u>

Further Details:

- (a) Tree and Reed Planting Scheme for Caledon River;
- (b) Costs and Organisation;
- (c) Duration of Scheme.

Explanatory Notes on the Tables

TABLE I

Open Arable: That area considered fit for cultivation by virtue of the fact that it can be protected against erosion by simple anti-erosion measures, e.g. contour furrows and buffer strips.

Closed Arable: That area considered unfit for cultivation due to its susceptibility to erosion and the difficulty in protecting the soil if cultivated. Soil depth, slope, erosion and proximity to stream, gullies and meadows are taken into consideration.

Open Grazing: The portion of the natural veld which is considered fit enough to carry stock at normal rates.

Closed Grazing: The portion of the natural veld which cannot carry stock at normal rates. Even light grazing is not permitted as this may lead to selective grazing.

TABLE II

Same as for Table I.

TABLE III (a)

This is a comparison of the two areas based on the percentage of the total area of Tebetebeng and Taung of each category.

TABLE III (b)

In this case the figures are the percentages of the area cultivated and area grazed.

TABLE IV

Broad Beaconing: This means beaconing whole features as dictated by local erosion and certain typical features of slopes and proximity to the river bank. This beaconing is not confined to a fixed distance from the river bank. Where the river makes a very sharp meander with a narrow "waist" this whole meander may be included in the beaoned area and all cultivation closed within the meander.

Simple Beaconing: This refers to beaconing that is confined to a fixed yardage. This beaconing distance varies from five yards along stable slopes to a maximum of twenty yards on unstable slopes.

The point from which the distance is measured is taken as that place where the land begins a steep slope down to the river. It will also include old river courses which are still in evidence along the banks.

Reserves: This is that portion of the river that borders on camp reserves (Leribe and Maseru) and fall under reserve authority control.

TABLE V

Percentage Broad Beaconing per District: This factor is expressed in terms of the percentage of the total length of the river in the district.

It will be noticed this percentage decreases as we go downstream. This tendency coincides very accurately with the topographical differences between the northern and the southern districts. It may be assumed to indicate that the northern districts, with their rougher topography, are less available to cultivation than the southern districts. This fact alone has a most pronounced influence on the form of agricultural economy to be applied.

TABLE VI (a) and (b)

These merely indicate the acreage of land at present under cultivation which will be closed by the beacons, under the two categories.

TABLE VII

These figures indicate the number of trees that can be planted above the borders of the river and within the beaoned zone. However, when one considers the area available down the slope of the river bank, one may double or even treble this amount. The figures as illustrated are based on ten-foot spacing which will be considerably reduced down the river bank to the water's edge.

Soil Conservation Officer.

SECTION V

FORESTRY

Due mainly to two major causes this year was not as successful as might have been expected. Whereas a steady improvement from

year to year was the aim, the year under review barely surpassed the previous one as far as the number of plantings in the field is concerned and must, therefore, be considered rather disappointing.

The two major causes referred to above were:—

(a) *Drought*. This persisted throughout the winter and spring, only breaking in November, when it was too late to plant rooted poplars out in the field. Because of the drought many rooted cuttings which were dug up to make room for fresh cuttings were not taken to the field and planting which was done was more expensive as the young trees had to be watered from time to time.

Material planted, however, has been surprisingly good in take, quality and growth.

(b) *Money*. Most of the funds for forestry work are supplied from C.D.W. Scheme 2707. This year, however, the B.N.T. agreed to assist with a substantial sum which was made available directly to districts. A certain amount of confusion arose when the Forestry Officer spent the total sum granted without paying due attention to the district allocations.

Nurseries

District nurseries were all further enlarged and many more cuttings put in. Two new field nurseries were completed and cuttings planted. three others are being prepared.

Fencing

Six hundred and fifty-one acres were fenced in and tree planting started in these areas, while 185 acres in other areas are nearing completion. Except in the Maseru district, where fences have been deliberately broken down so that animals could be grazed in the plantations at night, fences have been respected. The chief in the offending area in Maseru has been made aware of this and has promised to see that this does not happen again. Minor repairs to plantation fencing were carried out in the normal course of work.

Old Plantations

As there were demands from the public to be given or sold trees in the old plantations, the question was put before the Paramount Chief (on two occasions) for a ruling regarding the felling and use of the trees. The matter is still under consideration.

Fruit and Ornamental Trees

In many district nurseries large quantities of peach trees have been planted but only in the Berea district has the nursery been cleared of these. In other districts people have not demanded them to the extent anticipated; hence thousands of seedlings which should have been taken for planting by the people have been left in the nurseries.

Ornamental trees have only been required by European members of the public and have little appeal to Africans. They are, therefore, produced on a very small scale.

Caledon River

The planting up of the banks of the Caledon River to willows by the use of matsema labour which had gone so well in 1957 was held up because a survey of the river was to be carried out with a view to ascertaining which portions of the banks required fencing in order to ensure protection of the trees planted. This survey has now been carried out by the Soil Conservation Officer and arrangements to start the fencing are in hand. This work is considered to be of great importance and will be given the high priority it deserves.

The great lesson to be learned is that where fencing is provided trees can be successfully grown in Basutoland.

The following is a list of trees planted during the year:—

<i>District</i>	<i>Conifers</i>	<i>Poplars</i>	<i>Willows</i>	<i>Total</i>
Butha Buthe	1,113	19,014	5,283	25,410
Leribe	1,528	18,237	1,198	20,963
Teyateyaneng	339	30,371	320	31,030
Maseru	1,227	65,654	2,821	69,702
Mafeteng	3,241	57,321	1,036	61,598
Mohale's Noek... ..	2,371	75,568	2,161	80,100
Quthing	750	3,407	—	4,157
Totals	<u>10,569</u>	<u>269,572</u>	<u>12,819</u>	<u>292,960</u>
Grand Total	<u>292,960</u>			

N. G. NCHEE,
Forestry Officer.

SECTION VI

STATISTICS

Administrative Matters

Although the Agricultural Statistician was appointed in November, 1957, no specific funds had been made available to enable him to carry out his duties. Without the assistance of the Director of Live-stock and Agricultural Services very little could have been done in the interim period. Valuable assistance has been given by one lady clerk appointed by the Agricultural Department in May, 1958, to assist the Statistician.

An application for a research grant from Colonial Development and Welfare Funds has been made for April, 1959. These funds will be used for the creation of a permanent statistical section which will be responsible for the collection, analysis and interpretation of data and may well form the nucleus of a new statistical division in the territory.

Work Done

During the year the Statistician has been concerned with the

analyses of yield data from eighty-nine field experiments conducted by the Maseru Experiment Station and ten conducted by the Department of Land Utilisation, Swaziland, under Colonial Development and Welfare Scheme R. 758 (Soil Fertility Worker).

Assistance has also been given to sectional officers carrying out different projects in the country and, in particular, to the World Health Organisation Nutrition Survey Team on various nutritional data which have been collected in the field. In addition a series of lectures was given to the assistant staff of the W.H.O. team on Vital Statistics Methods and on the use of calculating machines. It is hoped that these lectures will continue and that officers requiring information on statistical techniques in their work will be assisted.

Work on agricultural statistics has also been started but, owing to lack of funds, it has not been possible to provide a suitable medium for the collection of accurate data in the field. However, an abstract giving a summary of all figures compiled during the year, which are regarded as accurate enough to be published, will be issued separately.

The Future

Up to now no records of crop production have been kept in Basutoland. One of the immediate functions of a statistical section would be to establish a permanent system of collecting current agricultural statistics on the acreage of land under various crops and the yield per acre in order to estimate production.

For this purpose it has been suggested that this section should participate in the 1960 World Census of Agriculture, preparations for which are now being made. This survey will be of great benefit in improving current methods of collecting agricultural statistics and providing bench marks on which to base all future statistical material.

C. M. H. MOROJELE,
Statistician.

APPENDIX I

MEAN MONTHLY RAINFALL

(Nine stations, at District Headquarters)

1957		<i>Inches</i>	<i>Average for 8 years</i>	<i>Deviation</i>
September	...	5.75	0.9	+4.85
October	...	6.58	2.5	+4.08
November	...	4.03	3.39	+0.64
December	...	3.80	4.60	-0.80

1958		<i>Inches</i>	<i>Average for 9 years</i>	<i>Deviation</i>
January	...	7.30	4.80	+2.50
February	...	2.83	5.53	-2.70
March	...	2.41	3.49	-1.08
April	...	3.41	2.42	+0.99
May	...	2.19	1.20	+0.99
June	...	0.14	0.37	-0.23
July	...	0.02	0.37	-0.35
August	...	0.00	0.32	-0.32
September	...	1.19	0.93	+0.26
October	...	1.48	2.39	-0.91
November	...	4.85	3.55	+1.30
December	...	5.39	4.69	+0.70
Yearly Total	...	31.21	30.06	

Annual Average for 42 years: 29.26 inches.

Territorial °C. Average Air Temperature, 1958

	<i>Absolute</i>	<i>Extremes</i>		<i>Means of</i>		
<i>Highest Max.</i>	<i>Lowest Min.</i>	<i>Lowest Max.</i>	<i>Highest Min.</i>	<i>B Min.</i>	<i>A Max.</i>	<i>Means of A and B</i>
32.5	−6.0	0.0	28.2	8.9	18.5	13.7

APPENDIX I (Contd.)
Territorial Average--Dry and Wet-Bulb Thermometer Readings Relative Humidity (14.00 hrs. S.A.T.) 1958

Readings	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Dry Bulb ...	22.8	24.5	23.0	20.9	18.3	14.6	15.6	17.2	19.1	22.1	23.5	23.0
Wet Bulb ...	17.4	16.1	15.2	13.6	10.5	7.4	8.1	7.6	10.8	13.1	15.3	15.7
Relative Humidity ...	58 %	40 %	42 %	43 %	35 %	33 %	33 %	19 %	33 %	33 %	40 %	45 %

APPENDIX II
Livestock Industry Statistics

	Cattle	Horses	Mules	Donkeys	Sheep	Goats	Totals
Census 1949 ...	430,998	98,832	2,468	48,905	1,557,546	609,267	2,748,016
1951 ...	401,221	102,903	3,089	59,188	1,564,001	637,065	2,767,467
1953 ...	406,454	92,884	3,550	53,543	1,303,325	550,612	2,410,368
1955 ...	408,144	102,001	4,829	48,855	1,339,019	654,800	2,557,648
1957 ...	381,770	81,661	3,599	48,616	1,220,769	535,286	2,271,701
1958 ...	362,897	81,115	3,753	49,098	1,231,699	505,562	2,234,123
Exports ...	12,290	52	—	—	4,077	361	—
Imports ...	15,304	4,951	197	118	1,282	45	—
Wool Exports (lb.) ...	—	—	—	—	6,289,004	—	—
Mohair Exports (lv.) ...	—	—	—	—	—	991,999	—
Bones Exported (lb.) ...	934,020	—	—	—	—	—	—
Hides Exported (units) ...	39,970	—	—	—	—	—	—
Skins Exported (units) ...	—	—	—	—	—	—	94,431

APPENDIX III
Importation of Maize from the Union of South Africa
(BAGS OF 200-LB. NETT)

<i>Season</i>	1950/51	1951/52	1952/53	1953/54	1954/55	1955/56	1956/57	1957/58	1958/59	<i>Average</i>
May ...	4,559	4,263	2,027	3,381	5,083	16,728	9,961	3,854	7,732	6,399
June ...	1,797	7,179	525	1,378	2,204	7,272	6,993	4,345	3,375	3,896
July ...	803	7,386	3,159	1,172	1,834	8,866	1,521	3,842	6,842	3,936
August ...	244	14,259	6,210	6,765	4,405	15,819	3,895	3,966	2,253	6,424
September ...	159	14,262	6,239	644	2,582	26,250	1,593	2,633	2,937	6,367
October ...	177	19,395	9,909	2,002	6,265	33,340	4,137	4,600	7,631	9,719
November ...	8,102	38,292	12,453	1,506	2,514	40,416	4,580	7,202	6,736	13,533
December ...	10,373	37,236	15,827	768	4,703	36,038	7,743	9,738	12,484	14,990
January ...	8,957	41,479	8,960	1,876	6,220	25,608	14,687	17,201	—	15,624
February ...	5,410	25,499	6,079	6,691	5,407	2,915	7,173	19,268	—	9,805
March ...	6,969	16,955	6,281	7,182	7,641	24,285	18,732	13,593	—	12,705
April ...	8,582	12,186	2,276	6,418	15,387	12,411	9,888	7,847	—	9,374
Total ...	56,132	238,391	79,945	39,783	64,245	249,948	90,903	98,089	49,990	112,772

APPENDIX III (Contd.)
Crop Marketing Statistics—By Licensed Traders
(IN 200-LB. BAGS)

Month	MAIZE and MEALIE MEAL				WHEAT				SORGHUM			
	Stock beginning of month	Amount bought	Amount sold	Stock end of month	Stock beginning of month	Amount bought	Amount sold	Stock end of month	Stock beginning of month	Amount bought	Amount sold	Stock end of month
June...	5,334	17,904	1,616	21,622	10,116	4,586	6,281	4,821	8,072	8,343	3,008	13,407
July ...	23,140	34,249	3,279	54,110	9,624	2,595	3,444	8,775	15,087	5,770	4,984	15,873
August ...	51,111	12,192	5,205	58,098	9,329	1,152	1,419	9,062	15,333	3,859	4,274	14,918
September ...	52,274	6,255	7,268	51,261	8,906	555	1,421	8,040	13,091	1,900	3,193	11,798
October ...	55,217	4,656	11,867	48,006	6,992	400	1,807	5,585	12,880	1,378	3,877	10,381
November ...	47,501	5,493	16,497	36,497	5,543	733	1,948	4,328	10,861	1,399	3,127	9,133
December ...	36,822	8,398	21,530	23,690	3,885	344	1,672	2,557	9,456	1,456	3,240	7,672

APPENDIX IV

STAFF

In the list which follows are given dispositions of staff as at 31st December, 1958:—

MASERU

D. D. Campbell, M.C.	Director of Livestock and Agricultural Services
P. H. Brown	Principal Veterinary Officer
S. H. Youthed	Soil Conservation Officer
J. G. S. Bennie	Wool and Mohair Officer
D. C. L. Wacher	Veterinary Officer
C. M. H. Morojele	Statistician
A. C. Macintosh	Agricultural Officer
J. R. L. Kotsokoane	Agricultural Education Officer
A. G. Brightmore	Senior Agricultural and Livestock Officer
G. Nchee	Forsetry Officer
R. F. Phillips	Accounting Clerk
Miss H. B. Corney	Senior Lady Clerk
F. Makhooane	Clerk/Storekeeper
Mrs. C. E. Carton	Lady Clerk/Typiste
M. C. Oosthuizen	Assistant Soil Conservation Officer
S. Letsie, B.E.M.... ..	Agricultural and Livestock Officer
N. J. Molapo	Administrative Assistant
T. Motsamai	Senior Veterinary Assistant
C. A. Motsamai	Teacher-Boarding Master
L. A. Makoa	Teacher
	1 Senior Conservation Foreman
	2 Soil Conservation Foremen
	13 Demonstrators
	3 Veterinary Assistants
	12 Assistant Demonstrators
	11 Clerks

MAFETENG

E. J. V. Wiggill... ..	Agricultural and Livestock Officer
	1 Soil Conservation Foreman
	1 Veterinary Assistant
	3 Demonstrators
	6 Assistant Demonstrators
	1 Clerk

MOHALE'S HOEK

A. Bisschoff	Senior Agricultural and Livestock Officer
I. W. Tennent	Assistant Soil Conservation Officer
H. B. Wroughton	Agricultural and Livestock Officer
	1 Veterinary Assistant
	3 Demonstrators
	7 Assistant Demonstrators
	1 Clerk

QUTHING

V. S. Gilbey Agricultural and Livestock Officer
 1 Veterinary Assistant
 5 Demonstrators
 8 Assistant Demonstrators
 1 Clerk

QACHA'S NEK

P. W. A. Davies ... Agricultural Officer
 J. J. Axentowicz ... Agricultural and Livestock Officer
 1 Veterinary Assistant
 5 Demonstrators
 6 Assistant Demonstrators
 1 Clerk

MOKHOTLONG

C. M. K. Seape ... Agricultural and Livestock Officer
 1 Veterinary Assistant
 4 Demonstrators
 11 Assistant Demonstrators
 1 Clerk

BUTHA BUTHE, LERIBE AND BERE A

I. L. Chard Senior Agricultural and Livestock Officer

BUTHA BUTHE

A. Mathule Assistant Agricultural and Livestock Officer
 1 Veterinary Assistant
 2 Demonstrators
 5 Assistant Demonstrators
 1 Clerk

LERIBE

E. A. Lesoli Assistant Agricultural and Livestock Officer
 2 Soil Conservation Foremen
 1 Veterinary Assistant
 5 Demonstrators
 6 Assistant Demonstrators
 1 Clerk

BEREA

D. Lekena, B.E.M. ... Agricultural and Livestock Officer
 1 Veterinary Assistant
 1 Soil Conservation Foreman
 4 Demonstrators
 4 Assistant Demonstrators
 1 Clerk

PILOT PROJECT

D. H. Taylor	...	...	Administrative Officer (seconded)
P. Millin	...	...	Agricultural and Livestock Officer (seconded)
J. H. K. Muller	...	...	Mechanic-Supervisor
G. Mochochoko	...	...	Development Officer (seconded)
E. Ramokhele	...	...	Development Officer (seconded)
E. M. Makhetha	...	...	Assistant Education Officer (seconded)
			1 Soil Conservation Foreman (seconded)
			1 Co-operative Organiser
			3 Demonstrators (seconded)
			1 Clerk (seconded)
			1 Clerk-Recorder

MECHANISED GROUP FARMING

A. H. Gibson	...	...	Agricultural and Livestock Officer
P. Tsoeu	...	...	Assistant Agricultural and Livestock Officer

VACANCIES ON ESTABLISHMENT

- 1 Principal Agricultural Officer
- 14 Assistant Demonstrators

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